OTTER CREEK CONSERVATION REPORT 1962

SUMMARY

DEPARTMENT OF LANDS AND FORESTS

HON. A. KELSO ROBERTS, Q.C.
MINISTER

F. A. MacDOUGALL
DEPUTY MINISTER

OTTER CREEK WATERSHED

Oak forests are typical on the sandy soils. Originally they contained much more pine than at present.

OTTER CREEK CONSERVATION REPORT 1962

compiled by

CONSERVATION AUTHORITIES BRANCH

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ONTARIO

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INTRODUCTION

With the advent of the new concept of personal and community responsibility in conservation, the Authorities movement was born, and the willingness of the people to undertake conservation work in this way is indicated by the fact that in the last 16 years 31 Authorities have been established, with a total membership of 455 municipalities and an area of 20,653 square miles.

The Otter Creek Conservation Authority was established by Order-in-Council on August 5, 1954, following an organization meeting which was held at Tillsonburg on July 20, 1954, when 14 municipal representatives out of a total of 14 attended the meeting and 12 voted in favour of establishing the Authority. Since then the Authority has been enlarged twice to include all the streams as far east as the west boundary of the Big Creek Region Authority and as far west as the west boundary of Bayham Township.

The Department of Lands and Forests, as a service to an Authority, undertakes to carry out a conservation survey of the valley for the guidance of the Authority, but the commencement of conservation work in the valley does not necessarily have to wait until such a survey has been made and the report presented. This has been the case with the Otter Creek Conservation Authority, and much excellent work and planning have been done independently of the reports which have been prepared by this department. For example the Authority has already acquired 1,042 acres of land for the Authority Forest and has also acquired some land for Conservation Areas near the Imperial Dam at Tillsonburg, the Edison burial ground at Vienna and the landing at Port Burwell.

The Otter Creek Conservation Report 1957 covered the subjects of History, Land, Forests, Water and Wildlife, and was presented to the Authority on April 30, 1957. Two hundred copies were mimeographed as a working plan for the Authority and other officials. A summary of this large volume, with revisions bringing it up to date, for distribution to the people of the watershed is presented herewith.

—A.S.L.B.

Otter Creek Conservation Authority

Established August 5, 1954
Enlarged February 2, 1956
Enlarged March 29, 1961

Chairman	C. BERTRAND
Vice-Chairman	H. PALMER
Secretary and Field Officer	W. D. ADLAM
Treasurer	Mrs. M. RUTHERFORD

MEMBERS:

Bayham Township	R. CARSON
Burford Township	*A. PRIEST
Dereham Township	J. R. McLAUGHLIN
Houghton Township	*J. MARSHALL
Malahide Township	W. R. CAVERLEY
Middleton Township	L. STILLWELL
Norwich Village	H. McCOMBS
Norwich North Township	*C. BERTRAND
Norwich South Township	*R. H. LEE
Oxford East Township	J. ALLAN
Port Burwell Village	H. O. ALWARD
Tillsonburg Town	C. RONSON
Vienna Village	*H. PALMER
Windham Township	C. McBRIDE
Walsingham North Township	J. CSUBAK
Ontario Government	*H. WILLIAMS
	C. M. FIDLIN
	A. N. WRIGHT

* Member of Executive Committee

CONSERVATION AUTHORITIES BRANCH

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Supervisor of Administration:
F. G. JACKSON, B.Sc.F., R.P.F.

Supervisor of Engineering:
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Soils and Land Use:
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Forestry:
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Wildlife and Recreation:
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Historical Research:
V. B. BLAKE

Supervisor of Field Officers:
A. D. LATORNELL, B.S.A., M.S., P.Ag.

Authority Field Officers:
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TABLE OF CONTENTS

1. HISTORY

2. LAND

3. FOREST

4. WATER

5. WILDLIFE

Recommendations

Stated or Implied in This Report

HISTORY

1. That, before carrying out any project, the Authority ascertain from the Royal Ontario Museum of Archaeology at Toronto whether the area concerned is likely to contain archaeological material and if necessary arrange for the investigation of the site before operations make this difficult or impossible.

2. That where records, buildings and objects exist of sufficient interest as illustrating the life of the watershed during the period of development, the preservation of these relics be considered an aspect of conservation; and that where such records and other relics are the private property of individuals and corporations within the watershed, the Authority take definite measures to encourage their preservation by their owners or by the commitment of these to proper care in libraries, museums, archives and other suitable repositories.

3. That when sites, buildings or ruins of structures of this kind form part of, or are adjacent to, properties acquired by the Authority for flood control, reforestation or recreation, the possibility of including them in the scheme be considered.

4. That in such cases sites be marked, ruins preserved and buildings restored and used for some purpose in connection with the project compatible with retaining their original character.

5. That the Authority appoint an Historical Sites Advisory Board to make recommendations to it with regard to matters of historical interest, including the preservation of historical buildings and relics.

6. That from the large number of sites and buildings of historic interest (in the wider sense used in these recommendations) to be found within the watershed, a few be selected for eventual inclusion in the scope of the activities of the Authority, besides those connected with recommended projects.

7. That this selection include the sites of the mills known to have been in operation before 1840, of the first Forge at Tillsonburg, the deposits of iron in Dereham and Middleton Townships, and of some other early mills and factories; of some other buildings of historical interest that have been destroyed and some existing buildings interesting for their associations or age.

8. That a survey be carried out to ascertain what objects of historical interest exist in the watershed and how some of these may be preserved in the future.

9. That, wherever possible, the buildings be left on their original sites and continued in their original use or adapted to some suitable purpose in connection with the normal life of the community.

10. That the Authority provide as part of its recreation program an area or areas where buildings which it is desired to preserve may be re-erected when they cannot be retained on the original site.

11. That these recommendations be taken as applying especially to the old flour mill at Otterville and that the Authority consider such action as may be necessary to prevent the destruction or radical alteration of this building and investigate the possibility of using the area around the mill and pond for historical purposes.

LAND USE

12. That, to further the development of the little valley, the Authority obtain as fully as possible the assistance and co-operation of the individual farmers in the valley and also of local groups interested in better land and water conditions.

13. That the Authority promote the construction and installation of special conservation measures where these are deemed desirable. The grassing of waterways and the control of gullies are two items which should receive early attention.

14. That the Authority urge each farmer in the watershed to have his farm planned, and that the Authority consider employing a competent man for a short period for the purpose of carrying out the necessary extension work.

FORESTRY

15. That the Authority, under agreements with co-operators or through lease or purchase of suitable woodlots, undertake the development of Woodlot Improvement Projects to demonstrate the advantages of better forestry practice.

16. That an Otter Authority Forest be expanded through a definite program of annual additions and planting until the total recommended area of 4,909 acres is acquired and reforested.

17. That the Authority encourage private reforestation by providing a planting service at nominal cost and/or offering a subsidy for approved private planting projects.

18. That the Authority, by purchase of equipment, organization of cutting crews, or direct subsidy, encourage private owners in thinnings and improvement cuttings in their woodlots.

19. (a) That the Authority investigate the Halton County fencing scheme and adopt such a modified scheme as seems most likely to result in elimination of woodland grazing.

    (b) That the Authority publish a simple, attractive bulletin on the disadvantages of woodlot grazing.

20. That the Authority co-operate with schools, government departments and all other groups and agencies possible to publicize the need and the methods of reforestation and woodlot management; and in particular that the Authority sponsor tours, practical demonstrations and field days for this purpose.

21. That the Authority encourage and co-operate in research on the best methods of establishing and managing woodlands under local conditions.

22. That the Authority act as co-sponsor for:

    (a) 4-H Forestry Clubs,

    (b) the Tree Farm movement.

23. That the Authority assist in investigating and publicizing markets and marketing methods for woodlot products to encourage:

    (a) maximum use of low-grade materials from thinnings and improvement cuttings,

    (b) closer and more uniform appraisal of timber, whether standing or in the log,

    (c) marking of trees for removal,

    (d) securing of competitive bids for timber,

    (e) insistence on a written Timber Sales Contract.

24. That the Authority investigate and urge the implementation of the best method of providing fire protection for wooded areas within the watershed in co-operation with the Department of Lands and Forests.

25. That the Authority encourage the establishment of windbreaks and shelterbelts.

26. That conservation storage reservoirs be considered in order to regulate the spring run-off and store water for use during the drier summer months.

27. That a detailed ground water study be made to determine the potential water yield from this source.

28. That some action be taken immediately to acquire the lands of the recommended reservoir sites in order that they will be available when required.

29. That improvements be made in the treatment of both industrial and municipal wastes.

30. That an extensive education program concerning pollution control be directed to both individuals and corporations. This should include the need for prevention of the dumping of refuse along the edges of or in the rivers.

31. That a Pollution Advisory Board be formed within the Authority which would make a special study of some of the needs as outlined in Chapter 4 of this report.

32. That the practice of channelling through the heavy ice sheet at the mouth of the river be continued to prevent ice jams.

33. That the Authority establish a flood warning system and appoint observers at strategic points along the river to alert the people farther downstream.

34. That every precaution be taken to prevent any further encroachment on the flood plains.

35. That the construction of the Low Tillsonburg Dam and Reservoir be given early consideration.

36. That the remaining dams and reservoirs be constructed as required.

37. That a series of community ponds be constructed throughout the watershed.

WILDLIFE

38. That the stocking of fish in this watershed be restricted to those streams which have been shown on the map accompanying this report to be suitable for the species concerned.

39. That a Fish and Wildlife Advisory Board of the Authority investigate and report on the subject of keeping a permanent flow in those stream courses which are injuriously affected by depletion from irrigation.

I HISTORY

CHAPTER 1

THE INDIANS AND THE FRENCH

In 1615 Etienne Brulé passed through the territory of the Neutral Indians on the north shore of Lake Erie on his way to the Andastes, a tribe living in the present state of Pennsylvania, and was probably the first white man to see the territory surrounding Otter Creek.

The eminent and observant Jesuit, Francis Joseph Bressani, writing in 1653, gives the following account of the country of the Neutrals:

> "To the south, on the shores of this great lake (Huron), dwelt the people whom we call the 'Nation of the Petuns', so named from the great quantity of tobacco which they raise and to which they give the name of petun. To the south, but leaning towards the east, dwelt the Neutral Nations. Their nearest villages to us, who live at Ossossane of the Hurons, are distant about one hundred miles. Their territory is about one hundred and fifty miles in length."

These hundred and fifty miles would include all the land extending from thirty miles east of the Niagara River to the St. Clair flats.

The Franciscan priest, De la Roche Daillon, who visited the Neutrals in 1626, speaks of the favourable climate which their country enjoyed, and notes the abundance of deer, moose, panthers, bears, wild-cats, and squirrels in the forests.

Midway between the east and west limits of the country of the Neutrals, and facing the shore of Lake Erie, which formed their southern boundary, lay the watershed of the Otter Creek. None of the Neutral villages lying within the watershed has been identified by name; nor have the sites of the mission stations which the Jesuits established among them been definitely determined. But it is safe to say that the Otter Creek watershed lay close to the heart of the Neutral territory; that its soil bore a share of the peaceful husbandry and of the savage warfare in which the Neutrals engaged; and that it was the scene of some part of the labours, successes, and failures that attended the exertions of the Jesuit missionaries.

In the year 1650, the war between the Iroquois and the Neutrals was prosecuted with the ruthlessness and savagery for which both parties were notorious. The Senecas and Onondagas attacked a frontier town of the Neutrals, and captured or massacred 1,600 warriors and at least as many women and children. The following year they stormed another town, and after butchering the old men and children at the breast, carried off a number of prisoners, among them many young girls to be given as wives to Onondaga and Seneca warriors. In retaliation, the Neutrals captured a town of the Senecas, killed and scalped two hundred men, and tortured and burned fifty prisoners. The next wave of Iroquois vengeance was the last and marked the end of the Neutral Nation. Fifteen hundred Iroquois warriors crossed the Niagara River, and in rapid succession stormed village after village, tomahawked and scalped the inhabitants, and returned to their own country with troops of prisoners reserved for adoption or the flames. The rest of the Neutral villages were struck with panic. They abandoned their homes and their

hunting grounds, and fled to the west and north-west. Some of the tribal remnants found homes among the northern Algonquins. Others joined with the Andastes, and later were found taking part in a war against the Senecas. Some united with the survivors of the Hurons at Mackinac and on Lake Superior, and appear from time to time on the pages of history under the name of Wyandots. Their former territory on the shores of Lake Erie became part of "the beaver hunting grounds of the Iroquois".

For the ensuing few years, the country of the Neutrals lay deserted and almost unvisited. Claimed by the French, it was controlled by their enemies, the Iroquois; both exploration and missionary endeavour were at a stand-still, until gradually the passage of the years and the potentialities of trade inclined the Five Nations to abate the ardour of their hostility and to find ways of coming to terms with the French. Peace between the French and the Iroquois was made in 1667, and lasted nearly twenty years. Jesuits, Sulpicians, and Recollets were encouraged to undertake new missionary ventures, and Church and State combined to explore and develop the resources of a vast French empire in the western world.

In 1669, the Sulpicians, Francis Dollier de Casson and René de Bréhant de Galinée, part of the time accompanied by La Salle, travelled from Montreal to the Iroquois country on the south side of Lake Ontario, and from thence to Lake Erie. They passed the winter of 1669-70 near the site of the present village of Port Dover, in Norfolk County; and in the spring of 1670, partly by canoe and partly on land, they pressed on westward, passing one creek after another (including the Otter), until they came to where M. Jolliet had hidden a canoe, which he had told them how to find, probably on the banks of Kettle Creek. And so they proceeded into Lake Huron, and, abandoning their purpose of establishing a mission to the Pottawattamies, returned by way of the French and Ottawa Rivers to Montreal.

Once more the country of the Neutrals, the beaver hunting grounds of the Iroquois, was left deserted and forgotten. For the next hundred years almost nothing is heard of it.

CHAPTER 2

EARLY SURVEYS AND SETTLEMENT ALONG LAKE ERIE

The whole of the Otter Creek Watershed was included within a tract purchased, May 22, 1784, by the Crown from the Mississaga Indians, by a treaty which described the tract. The tract extended from Niagara on the Lake to Catfish Creek.

Before the division of Canada in 1791 into the two Provinces of Upper and Lower Canada, the country was divided into Districts; and the responsibility for locating settlers lay with the Land Board of each such District. All the territory lying to the westward of the eastern extremity of Long Point constituted the District of Hesse; and the Land Board of the District of Hesse was at Detroit, which had not at that time been ceded to the United States.

On the 16th of June, 1790, Patrick McNiff, "pursuant to the order of Patrick Murray Esquire Commandant of Detroit &c.," set out along the shores of Lake Erie to examine and report the suitability of the lands between Detroit and Long Point for settlement. Ten days later he had returned to Detroit, and on June 26th

handed his report to the Clerk of the Land Board. His report gives one of the earliest accounts of the lake-front appearance of the lands in the vicinity of the Otter Creek: his account is not flattering.

> "From Pt. au Pins to the Portage at Long Point no possibility of making any Settlement to front on the Lake, being all the way a Yellow & white Sand bank from 50 to 100 feet high Top Covered with Chesnut & Scrubby Oak, and no Harbours where even light Boats may enter except River Tonty [Talbot Creek] & River a la Barbue [Catfish Creek]; a Load Boat may enter the Latter having 4½ feet Water on the Bar; on each side of River a la Barbue are flats of excellent Land, but not above 15 or 20 Chains Wide before very high Land Commences which in many places does not appear to be accessible for any Carriage [i.e., for any mode of transportation]. On the Tops of these very high hills Good Land, Timber some large Chesnut, Hickery & Bass. These Hills are seperated by dry Ravines almost Impassible from their great Depth."

It is believed that this unfavourable report led the Land Board at Detroit to encourage settlement along the Thames River rather than along the shores of the lake. The townships based on Simcoe's new road from Burlington Bay to the Thames (Dundas Street)—Burford, Oxford and Windham—were the first of those comprised in the Otter Creek Watershed to be laid out; these were followed by Dereham and Norwich, and still later, by Houghton, Bayham, and Malahide. It was more than thirty years after the date of McNiff's report before the Township of Middleton was surveyed.

BURFORD

On the same day that instructions were given to Augustus Jones, Deputy Surveyor, to lay out Dundas Street from Burlington Bay to the River Thames, March 19, 1793, the Surveyor General also issued instructions jointly to Augustus Jones and Lewis Grant to lay out the Township of Burford: "a Township Southerly of the afore mentioned Road, adjoining the Indian Land", that is to say, lying on the west side of the lands granted to the Six Nations Indians, bordering the Grand River. On the 29th of July, 1794, instructions were issued to Abraham Iredell, Deputy Surveyor, to lay out four concessions in Burford Township, and two months later, Augustus Jones was instructed to lay out an additional two concessions. The Otter Creek drains the westernmost eight or ten lots in Concessions 11, 12, 13 and 14, comprising about one-eighth of the entire township.

OXFORD EAST

Augustus Jones surveyed the Township of Oxford in August and September, 1794, and quit the survey without completing it. Another surveyor, Charles Whiting, carried forward the survey, still without distinguishing between Oxford East and Oxford West, in November, 1796. In February and March, 1798, Augustus Jones returned to this township but was immediately ordered to go to York to perform some surveys required there. The survey of Oxford was completed by William Hambly, in 1800.

WINDHAM

This was another township granted *en bloc* to a company of settlers. On the 4th of October, 1794, instructions were issued to Augustus Jones to survey the "Outlines of a township for Pierce & Associates, in the rear of Mr. Dayton's


MUNICIPALITIES
LEGEND
RECOMMENDED AUTHORITY FOREST
WOODLOT IMPROVEMENT PROJECTS
SCALE - MILES
BURFORD
OXFORD
WINDHAM
NORWICH
NORWICH
DEREHAM
MIDDLETON
WALSINGHAM
BAYHAM
MALAHIDE
HOUGHTON
BURGESSVILLE
NORWICH
OTTERVILLE
SPRINGFORD
TILLSONBURG
COURT LAND
ELGIN
STRATFORDVILLE
VIENNA
PORT BURWELL
LAKE ERIE

(Burford) immediately behind and adjoining to the same". But Jones was employed toward the end of 1794 in carrying out minor surveys in the Niagara Peninsula, and in office work at Newark (Niagara-on-the-Lake); the instructions were transferred to William Hambly, and the Township of Windham was surveyed between August and December, 1797.

DEREHAM and NORWICH

The Deputy Surveyor, William Hambly, surveyed these two townships between the first of July and the 9th of December, 1799. His instructions were dated April 29, 1799: "You will . . . cause the Townships of Dereham and Norwich to be surveyed with all possible dispatch. . . . The outlines of the Townships are to be run with the Line down the middle between Lots No. 14 & 15—of 12 miles in depth, and *every other Concession* Line". Dereham Township was completed by Samuel S. Wilmot, in 1810; and the remaining lines of Norwich were run by Mr. Peter Lossing in 1821. Peter Lossing's plan of the township is still in the possession of members of the Lossing family.

HOUGHTON

In the winter of 1797-98, the Deputy Surveyor, Thomas Welch, of Charlotteville, was engaged in exploration for a proposed township lying to the west of Walsingham, to be called Houghton. On June 4, 1798, he was ordered to lay out the township which included the present townships of Malahide and Bayham.

BAYHAM AND MALAHIDE

These two townships were separated from Houghton in 1810. In the previous year, Burwell had explored the tract, and had surveyed the shore line in front of what was then called Houghton; and he had laid out the Talbot Road through the Townships of Southwold, Yarmouth and Houghton. He surveyed the present Township of Malahide between July 22nd and September 10th, 1810, and completed his survey of Bayham by December 24th of the same year.

MIDDLETON

Mahlon Burwell laid out the Talbot Road through Middleton Township in 1809-10. Not for another fifteen years was the rest of the township surveyed; in 1824, Burwell employed another surveyor, John McDonald, to perform this service, and the survey was reported as completed, February 28, 1825.

The Township of Burford, which was the earliest of ten townships to be surveyed, was also the first to be settled. This was to be expected along the northern boundary, the "Front" of the township, where the newly opened Dundas Street gave ready access; but it is true as well of the southern concessions, part of which are included in the Otter Creek Watershed.

The course of settlement in Upper Canada was subjected to a serious set-back during the War of 1812. For more than two years of the war, from June, 1812, to November, 1814, the actual fighting did not take place within the limits of the Otter Creek Watershed.

CHAPTER 3

THE TALBOT SETTLEMENT

The region known as the Talbot Settlement was still a forest wilderness when, on the 21st of May, 1803, Thomas Talbot, with four followers, landed at the

mouth of the little stream in the Township of Dunwich which has ever since been known by his name. The beginnings of his settlement operations took place with discouraging slowness in the Townships of Dunwich and Aldborough. Gradually gaining momentum, his scheme grew to unprecedented proportions, and additional townships were placed under his superintendence for settlement. "By the year 1835 these numbered 28 in all, including 540,443 acres actually under patent or under cultivation."

In the year 1809, with a view to making easier access to his settlement from the more easterly parts of the province, and of enhancing the value of the lands through which it would pass, Talbot proposed a plan for completing a road from the Township of Middleton, through Houghton, Yarmouth, and Southwold, to Dunwich. Thus came into being the main east-west artery of communication that came to be known as the Talbot Road, upon which settlement proceeded at a rate approximately fifteen years in advance of the settlement of the adjacent lands not situated on the road.

The success of the Talbot Settlement was the result chiefly of the almost fanatical drive with which Colonel Talbot performed the exacting task of meeting his applicants and assigning to them their lands. While the demands of the Government annoyed and irritated him, he managed in some measure to comply with their requirements, partly because that was the only way for his settlers to receive their Patents.

Colonel Talbot died at London, Canada West, (now Ontario), February 6th, 1853, and was buried in the cemetery of St. Peter's Church, at Tyrconnel, in the Township of Dunwich.

CHAPTER 4

GROWTH AND DEVELOPMENT

VILLAGES, AND OTHER COMMUNITIES

The Otter Creek Watershed includes one incorporated town, three incorporated villages, two police villages, and twenty-one unincorporated communities, of which nine have post offices.

TILLSONBURG

In 1824 an Indian in the employ of the Normandale works brought to Mr. Tillson information of a deposit of bog ore in Dereham Township; and the results of his exploratory investigations determined Tillson to erect a furnace on the banks of the "Big Otter Creek". In partnership with Benjamin Van Norman, he dammed the creek and built a forge; an over-shot water wheel provided the power to operate a double set of bellows which supplied the necessary air blast for the first "Bloomery Forge" in the Township of Dereham. The little settlement came to be known by the name of Dereham Forge.

As soon as the forge came into production, Messrs. Leavitt and Hogan set up an axe factory on Bloomer Street, the busy main street of the village, where a commodity indispensable in the life of the pioneer was produced entirely from local materials, at two dollars apiece.

In the 1860's, three great public issues occupied the attention of the people of Tillsonburg: salt, oil, and incorporation. In its issue of November 2nd, the

"Balloon View" of Norwich Village 1881

"Balloon View" of Tillsonburg 1881

Tillsonburg Observer reported that the necessary county by-law had been passed, October 13th, 1865. Tillsonburg continued as a police village, without incorporation, until its incorporation as a town, March 2nd, 1872, but the happy day when the flow of oil or the mining of salt would enrich Tillsonburg never dawned. The principal sources of Tillsonburg's prosperity have always been in industry and commerce, in processing and handling the products of the forests and the farms.

Probably the greatest contribution that Mr. E. D. Tillson made to the prosperity of Tillsonburg was the construction of a 500-foot dam across the Otter Creek. By this means he developed more than four hundred horse-power, which, through a succession of races, operated a foundry, a sawmill, a planing mill, and a grist mill.

VIENNA

On January 21, 1818, Lot 15 in the third Concession of Bayham Township was patented to Samuel Edison, grandfather of the great inventor, Thomas Alva Edison. This lot, along with Lot 14, provided the site that became the village of Vienna, January 1, 1853.

According to the Historical Atlas of Elgin County, 1877:

> "The development of the stave and lumber trade caused a rapid growth, and in 1850 it was one of the most stirring business places in Western Canada (i.e., Canada West, now Ontario). Its situation favored this—surrounded as it was by forests of pine and oak, with the Otter Creek, navigable to the lake, passing through it, along whose winding banks were excellent facilities for piling and shipping these rich native products of the township. In those palmy days of prosperity the piles of lumber reached from the Francisco House to the foot of Teale's Hill. There were sixteen general stores all doing a good business, and the usual complement of shops with workers in iron, leather and wood."

In 1855 and 1867 the village suffered very severe fires. Whether because of the "heavy blow" or for other reasons, the village never resumed its "busy and bustling appearance". It is probable that the "decay of the lumber trade" had most to do with the decline of Vienna as a business centre.

NORWICH

First known as Norwichville and incorporated as Norwich in 1876, this village grew up as the centre of the social and economic life of the northern half of the original Norwich Township, later to become Norwich North Township. Settlement of the township began with the purchase of 15,000 acres by Peter Lossing and his associates, in 1810.

In 1846, Wm. H. Smith's "Canadian Gazetteer" reported the village of Norwichville to contain about 180 inhabitants: "pleasantly situated on Otter Creek . . . post three times a week". The population increased to 700 by 1857 and to 750 by 1865.

PORT BURWELL

The present village of Port Burwell stands on Lots 10, 11, 12, and 13, in the first Concession of the Township of Bayham and Lots 10 and 11 had been granted to Colonel Mahlon Burwell, February 5th, 1811. He was impressed with the possibilities of navigation on the Otter Creek, and recommended the

Trinity Church (Anglican), Port Burwell 1836. The church and glebe were donated by Colonel Mahlon Burwell, D.P.S., founder of the village.

Beechcroft, Port Burwell, built in the 1840's by Leonidas Burwell on the estate given him by his father, Mahlon Burwell. The house had a light veranda on at least two sides. The present porch columns, brought from an old house in Detroit, may be some years older than this building.

formation of a harbour at the mouth of the creek and of a village on the adjacent banks. Burwell's estimate of the future navigation on the Otter proved to be unduly optimistic; but his vision of a village and harbour at the mouth of the creek has since been more than realized. The manner of the proposed development was not, however, entirely as he conceived it.

In the meantime, the harbour, such as it was, had come to handle a considerable volume of both imports and exports. John Burwell, a brother of Colonel Mahlon Burwell, was appointed Collector of Customs. He reported, early in 1835, that the imports at the Port of Port Burwell for the year 1834 amounted to a total of £475-13-3, of which the largest item, making up nearly half of the total, was leather. He was unable, in the absence of clearance records, to state the exact value of the exports, but estimated them at not less than £5,000, consisting chiefly of lumber, spars, masts, shingles, and shingle bolts.

All the difficulties, frustrations, and delays could not change the fact that there was a vast amount of traffic, of lumber, grain, and other produce, originating in and near the Township of Bayham, demanding to be transported. Indeed, it was just that demand that, in the face of economic, and some suspected political, handicaps, kept alive the agitation for a harbour at "the Port". "The Otter Creek proved the only source of outlet from the heavily timbered district, and Port Burwell the shipping point. From two to four hundred vessel loads were shipped annually through this port. . . . Following the timber period a new industry, that of shipbuilding, was opened at the Port, and a large number of vessels of various sizes were built here."

Port Burwell was erected into a police village in June, 1900; and became an incorporated village, January 1, 1949.

BAYHAM POST OFFICE (RICHMOND)

The beginnings of Richmond go back a little further than the date of Caleb Cook's arrival in 1816, according to the St. Thomas Times-Journal 1949:

> "The real settlement of Richmond began in 1811 when James Gibbons and Joseph DeFields built log huts in the dense pine forests between the two Otter Creeks. Mr. Gibbons selected a spot near the bridge north of the Talbot road, then only a blazed trail through the woods. Mr. DeFields was the district's first magistrate, serving in this capacity from 1818 to 1832. The name 'Richmond' was derived from the Duke of Richmond, a close personal friend of Col. Talbot. . . . Despite the fact that postal authorities, because of duplication, use the name 'Bayham', the Richmond title still persists."
>
> "By the year 1837, the first business establishments, a tannery and general store built in 1819, had been increased by the addition of two stores, a second tannery, and two hotels."

In 1864 it had a population of about 300.

WILLSONBURG

About a mile north of the village of Richmond, some old maps show the evidences of the laying out of the village of Willsonburg. A short account of this abortive community by G. Neal Procunier was included in the Centennial Souvenir Book of Bayham Township, 1950.

CORINTH

This is a small, unincorporated community located at the intersection of the Tenth Concession road with the side-road between Lots 5 and 6, in the north-west part of Bayham Township. First known as Jones' Corners, it was given the name of Corinth when it became, in 1871, a station on the Air Line Railway. In 1950, Corinth had two general stores, a post office, two churches, one cheese factory, one grist mill, and one garage.

OTTERVILLE

The village of Otterville celebrated its Centenary in 1907 with, among other things, the publication of a valuable souvenir booklet, in which the history of the early years of the settlement is reviewed.

The greater part of the Township of Norwich (as it was then) was granted in large blocks to absentee owners, and almost all of the grants so made were patented in the year 1800. At the same time, two-sevenths of the lots in each concession were reserved for the Crown and the Clergy.

That part of Otterville, at the extreme west end of the village, which occupied both sides of the road in Lot No. 14, was known as Erbtown, after Mr. Abram Erb, who owned part of this lot both north and south of the road.

The following passages are extracted from the Centennial Souvenir Booklet, 1907, which contained "A short historical sketch of the picturesque village of Otterville".

> "Between 1850 and 1860, in and around Otterville, were the sites of no less than twelve steam and fourteen water mills, all cutting lumber, and nearly as many more making shingles.
>
> "Until 1870 the lumbering of white pine, which covered the land, formed one of the principal industries. Many other business enterprises were started, some of which have continued to the present day (1907).
>
> "After Edward Bullock bought from John C. Ferrie, in 1845, he built a custom woollen mill and the present flour mill. About 1854 there were a number of other industries. A foundry was built by David Stage, one of the products being the bell on the school house, which still calls the children to the seat of learning. The Erbs' saw and woollen mills, J. G. Williams' distillery, stock stables, and grain warehouses, John Furlong's shingle and cooperage shops, the Parsons carriage works, also a canning factory, potash works.
>
> "The change from the lumber industry to agriculture had been gradual, but sure, as little by little the old white pine stumps were uprooted and the land cleared. South Norwich farms can now bear comparison with any others in Oxford, and good roads, fine buildings, and prosperous farms are the rule. Much attention is given to stock raising, Otterville being a flourishing market for hogs. Cheese making is also a substantial source of revenue.
>
> "That our village of today (1907) is in a prosperous condition is proved by the large mercantile business done in the stores and other places of business. Two sawmills are still in operation cutting hardwood lumber. Among the

Otterville about 1874-76—a sketch made by W. Moore "from the residence of W. Watts", N.W. of the village. In the foreground the woollen mill (right), saw mill, casket factory, tannery and the Lossing flour mill (left). The shingle and match factories appear behind the flour mill to right and left.

The Treffry Flour Mill, Otterville, in 1955. This mill can be identified in the above sketch. It is little altered externally since 1875 or since it was built more than a century ago. The first mill here was built in 1807.

public buildings are three churches, school house, town hall, Oddfellows' hall, and Foresters' hall. In 1893 Otterville was made a police village, and since then the improvement has been marked."

BURGESSVILLE

This village occupies parts of four lots, being the four corners of the intersection of the road between the first and second concessions with the "Middletown Line Road". The following passages are taken from the account of Burgessville, in the Norwich Centennial Souvenir book, 1810-1910.

"It was first named Snyder's Corners, after Elias Snyder who came in 1811, who was the second teacher in the township and continued as teacher for several years, but afterwards took up land. . . . Joshua Corbin was another early settler who settled near where the village now is, in 1816. The Dennis family settled near Burgessville in 1820, and there are a great many of them still residing in the vicinity, the street running west from the four corners is named Dennis Street. Capt. Joshua Jacques moved into Burgessville in 1835, and was one of the prominent families in the early history of the village. William Topham was one of the early settlers of Burgessville, and cleared a farm in the forest. . . . The Emighs are also a pioneer family coming to the settlement near Burgessville in 1819. . . . E. W. Burgess, for whom the village was named, was born in the vicinity about 1821, and started the business of blacksmithing in 1844. . . .

"The first school buildings were log, then frame, and now a commodious brick. In 1833 Mr. De Los Hewitt was teacher; Mr. Snyder, the pioneer, and his son Elias Henry, were both teachers in the vicinity."

"In the early days there was no doctor in the neighborhood, and for a number of years Dr. Cooke, who settled in the township in 1831, was the only doctor in the township."

CORNELL

Not much is left in the year 1957 to mark what was at one time a flourishing little village, the centre of which was on Lot No. 15, in Concession X, Township of Norwich South. The history of Cornell is told at length in an anonymous manuscript, written in 1927, and at present in the possession of the Tillsonburg News. Much of its earliest history is shared in common with the early history of the township, and that of Otterville.

It was about 1855 that the two brothers, John and Samuel Cornell, settled in this vicinity and laid out part of Lot 15 into village lots, and called their venture Cornell. Here also they built a store, a warehouse, and a meat-packing house on the north-west corner of the road intersection.

SPRINGFORD

Earlier known as Springbrook, this village occupies the four corners of the intersection of the road between Concessions VIII and IX, and the sideroad between Lots 21 and 22, in the Township of Norwich South.

MILLDALE

Through the north half of Lot 7, Concession VIII of Norwich Township, flow two streams, the main stream of Otter Creek, and a tributary known as Crystal Creek. Each of these streams, in this half-lot, supplied power for the

operation of a mill; and the little hamlet that grew up around the mills was known by the appropriate name of Milldale. Now little remains, the mill-dams are gone and even the road is closed.

CHAPTER 5

MILLS

Before the year 1825, there are few reliable records of mills in the Otter Creek Watershed. Such as have been found are here briefly summarized.

Early accounts of Norwich Township state that John Earl and Paul Avery, about 1807, built a grist-and-saw-mill near the confluence of Sweet's Creek and the Otter, on land that is now Otterville. So far as can be ascertained, these mills, whether the same building, or a succession of buildings, have passed through the hands of the following owners, in the order given.

John Earl and Paul Avery	1807 —
Cook and Galloway	— 1824(?)
Cromwell and Schooley	1824 —
William Cromwell, in 1829 and until	— 1839
John C. Ferrie	— 1845
Edward Bullock	1845 — 1877
E. M. Schooley	1877 — 1880
S. B. Lossing	1880 — 1949
Lorne Treffry	1949 —(1957)

The Historical Atlas of Elgin County, 1877, refers to the founding of the village of Richmond (Bayham P.O.). "In 1816 Caleb Cook settled here, and Noah Cook soon after built a saw and grist mill on the Little Otter." A road description dated June 19, 1834, refers to "the mills belonging to Jesse Smith" at the village of "Shrewsberry", now Vienna.

From 1825 to 1846, the municipalities of Upper Canada made annual returns of much interesting statistical information, derived from their assessment rolls; and these were published in the Journals of the Legislative Assembly of the province. From that source have been assembled the data given in the tables in the report, the first showing the numbers of sawmills, the second the numbers of grist mills, in the seven townships that comprise over 97 per cent of the watershed. It is to be borne in mind that in some townships, notably Burford and Malahide, a considerable proportion of the mills reported were outside the watershed of the Otter Creek.

After 1846, the assessment returns became incomplete and unreliable, and by about 1851 were discontinued altogether.

It is quite impossible, in 1957, after the lapse of more than a hundred years, to identify the mills whose gross numbers only are reported in the assessment returns of the years indicated. A quick survey of the watershed, "on the ground", and an examination of such records as it has been possible to assemble, have provided the basis of a considerable number of notes, which, it is hoped, may, in turn, prove to be "pegs" on which further information may be hung.

1) Timbers of the dam at Jeremiah Moore's Grist Mill, Lot 3, North Talbot Road, Bayham Township. A public road to this mill from the village of Richmond was established in 1832. The remains suggest that the dam had a timber core —an early type of construction that continued to be used for more than a century.

2) The site of Beatty's dam, Lot 6, Con. 6, Bayham Township. The timbers in the foreground are the foundation of the crib abutments of the floodgate. They show notches for cross-timbers forming the cribs. Cribs filled with boulders were resorted to after 1830 in an attempt to limit flood damage. In this case the bridge was not part of the dam.

3) The dam at Rock's Mills between Otterville and Tillsonburg—an example of scientific modern construction.

MILLS IN BAYHAM

The full report contains 29 references to saw, grist, woollen, cider and other types of mills in Bayham. In some cases the locations are known and in others the sites may be identified by remains.

MILLS IN DEREHAM

It was at the site of Tillsonburg that the founder of the town, George Tillson, erected the first sawmill in Dereham Township, "a very primitive construction". Here, in 1863, his son, E. D. Tillson, was operating a sawmill, a planing mill, a sash-and-door factory, an oil-drilling machine, a flour-and-grist mill; while others used the water-power of the Otter and its tributary, Clear Creek, to operate yet other mills.

In the Historical Atlas of Oxford County, 1876, the plan of the Town of Tillsonburg shows Tillson's sawmill, planing mill, grist mill (all situated on Bloomer Street) and his oatmeal mill on Clear Creek just above its confluence with Otter Creek. A grist mill is shown on Lot 6, Concession XI, Dereham Township, on Clear Creek, on land of J. Smith; this is presumably the "fine new grist mill' of Messrs. J. & M. Smith, of Campbellton. A sawmill is shown on a branch of Clear Creek, just east of Broadway, which may be the one said (in 1863) to belong to Mr. Duncan McLaren. Not otherwise identified is a grist mill, shown on the same plan of Tillsonburg, at the west end of Washington Street, on Clear Creek. A woollen mill on Clear Creek, on the south side of Baldwin Street, said to be the property of a Mr. Waterhouse, may be the same as the one that in 1866 had been "recently leased by Mr. James Christie".

MILLS IN HOUGHTON

The Historical Atlas of Norfolk County, 1877, in the sentence quoted below, refers to two sawmills in Houghton Township:

> "The North Road leaves the Lake Road at the Hemlocks, and running past Safford's and Thos. Forsyth's sawmills, strikes the 'Talbot Street' as it crosses the northern part of the township."

Of Safford's mill no further mention has been made. It is possible that one of those indicated on Lot 9, First Range East of the North Road, was operated by Safford. It is even more likely that many more sawmills were, from time to time, in operation in Houghton Township than those listed.

The full report contains ten references to mills in Houghton Township.

MILLS IN MALAHIDE (OTTER CREEK WATERSHED)

1. In the Historical Atlas of Elgin County, 1877, the map of Malahide Township shows a mill on Lot No. 32, Concession V, on a tributary of Otter Creek, on land belonging to H. Pressey. No further identification has been found.
2. Information obtained in 1955, from various sources, indicated a sawmill on Lot No. 30, Concession VI, Malahide Township, on a tributary of Otter Creek known as "South Creek". Name of proprietor, and dates of operation, have not been ascertained.

MILLS IN MIDDLETON

There are seven references to mills in this township in the full report.

NOTICE!

The subscriber, having just completed the refitting of his mills with new and

IMPROVED MACHINERY

is now prepared to do all kinds of

CUSTOM WORK

in his line, viz.-

Sawing Lumber and Shingles by the thousand, or on shares, also Planing and Matching to order, and on short notice.
Lumber and Shingles constantly on hand.

BILLS CUT TO ORDER!

Shingles per. M. $2.00. Bill-stuff per M. $8.50. A quantity of season ted flooring on hand; also, a large stock of Furniture, Sash and Doors, which will be sold

CHEAP FOR CASH!

T. J. PENNINGTON,
SUCCESSOR TO SHAW & PENNINGTON.

Otterville, April 10th, 1877. York's Job Press

Rock's Flour Mill on the Otter halfway between Otterville and Tillsonburg in 1955. In spite of frequent damage to the dam in recurring freshets, this mill has continued in use for about a century. It has evidently been improved and enlarged more than once in recent years.

MILLS IN NORWICH TOWNSHIP

The full report separates Norwich Township into Norwich North and Norwich South and refers to four mills in the former and thirteen in the latter including those at Norwichville, Otterville and Milldale.

CHAPTER 6

CHURCHES

As was to be expected, the early settlers in Upper Canada, as in other parts of America, brought their religious affiliations and practices with them to their new homes. The first and most pressing need of each new family of settlers was for a home, a roof over their heads. Before the resources of any religious group were equal to the task of erecting a building to be set apart for the exclusive purpose of a place of worship, the services of the church were held in the homes, in the barns, or, where they were available, in the schools of the community. To such gatherings, as a rule, the people of all faiths and creeds were made welcome.

The Society of Friends, or "Quakers", in the Township of Norwich, held their earliest religious services in 1811 in the home of Peter Lossing, who, in addition to being their leader in business affairs, was also one of their ministers. In 1813, the Society built a frame meeting house on the hill, "where the old burying ground is", and there they worshipped for thirty-four years.

The first Methodist Church in Norwich Township stood on land given by Michael Stover in 1820. The church was built in 1824, though Methodist meetings had been held in the homes of the people since about 1812.

The "new church building erected in 1862" may have been a Wesleyan Methodist Church. A Methodist Episcopal Church was built in Norwich in 1877, and in 1885 sold to the Baptist congregation. The date-stone on the present (1957) United Church of Canada, in Norwich, bears the inscription: "Methodist Church, 1885". The first Wesleyan Methodist church in Port Burwell was begun in 1850, completed and dedicated in 1852.

The Methodist body known as the New Connexion Methodists had their own church in Tillsonburg in 1868, which they placed at the disposal of the Church of England minister and congregation, who at that date had not yet built one for their own use. As early as 1864, services of the Church of England in Tillsonburg had been held in the Presbyterian Church.

The United Church of Canada, in Otterville, was formerly the Methodist Church of that village, originally built in 1884. The Methodist Church in Burgessville was built in 1899.

According to the Port Burwell Centennial Book, 1930, the Baptist Church in that village was established in 1819.

The present (1957) Baptist Church at Port Burwell was built in 1865, and dedicated on December 17 of that year.

The Baptist Church at Springford was organized at a meeting held on October 6, 1832, in "the old block schoolhouse", just west of the village.

The Baptists in Norwich Village first organized in 1884, under the leadership of the Rev. H. Woodward. They had sixteen charter members. In 1885 they bought the former Methodist Episcopal Church building. Their parsonage was the historic John McKee home on Elgin Street.

Toward the end of May, in 1958, the Otterville Baptist Church celebrated its hundredth anniversary.

The Presbyterians in Tillsonburg were an established congregation with a building of their own, when, in 1864, they made their church available for a service of the Church of England.

In Norwich, the Presbyterian Church was first established in 1849, when a frame building, situated on John Street, was dedicated to the worship of God.

It was not until the 1840's, when emigration from Ireland on a large scale resulted from the political and economic conditions in that country, that any considerable numbers of Irish Roman Catholics found their way into Canada West, and brought with them the need for the services of their church. St. Peter's Church, in Norwich North Township, was erected in 1894 on the site of the earliest structure, a hand-hewn frame church built in 1853, on land donated by the McNally family. In 1944 the church celebrated its golden jubilee. For some 30 years before the original church was built, the early pioneers went to Beachville and other neighbouring churches, or when a visiting priest came to the community, they would meet in one of the homes.

One of the contributions that Colonel Mahlon Burwell made to the early life of Port Burwell was the building and endowing of a Church of England in that village which was dedicated on May 22, 1836.

In the year 1836, from February to October, the townships bordering on the Otter Creek were part of the territory to which the Reverend Thomas Green was assigned as Travelling Missionary. Green's journal of that year contains many references to places and people in the watershed, and shows that he maintained more or less regular services in Vienna, Port Burwell, Middleton (now Courtland), Norwich Township and Norwichville, and in the Townships of Windham and Malahide; on one occasion he records a visit to Dereham, but does not identify the precise locality. He names the people in whose homes he was entertained, who assisted, sometimes at short notice, in assembling the scattered congregations, and who opened their homes for the holding of a church service.

In 1865, the Church of England congregations in Tillsonburg still constituted a "mission", and had no church edifice of their own. In that year, the Reverend E. Peake was appointed to succeed the Reverend Andrew Fisher in the charge of that mission, as well as in charge of St. Charles' Church, Dereham, and the congregations at Otterville and Norwichville. In February, 1867, the first step was taken toward organizing an independent parish and on June 7, 1868 the church was formally opened.

CHAPTER 7

REBELLION OF 1837

The writers of local history and personal reminiscences in the course of the past hundred and twenty years make frequent reference to the troubled events of 1837, in which an armed rebellion in the Provinces of Upper and Lower Canada almost succeeded. The following passages are taken from the Norwich Old Home Week Booklet, 1946.

> "At the time of the Rebellion he (Dr. Ephraim Cook) helped Dr. Duncombe in every way he could and was sought after at once by McNabb's men. Many years later Moses Mott told one of his family how he took Dr. Cook out of the township in a load of hay."

> "In 1837 he (John Tidey) joined Dr. Cook and the other rebels, was taken prisoner, and lodged finally in the Hamilton jail. Miss Poldon gleaned from his diary the story of the sufferings of the captives: 'Discomfort, filth and vermin, and bad food broke their morale and their health. . . . Petitions were sent in, wives interviewed members of the Legislature, taking long journeys, sometimes walking.' Mrs. Tidey went to Hamilton to plead for her husband, her family being looked after by her neighbours while she was away. Finally, Mr. Tidey was released, and soon afterwards moved with his family into the growing village of Norwichville."

In the Township of Norwich, in December 1837, Dr. Duncombe had assembled an "army" of some two hundred men; and while the issue of the Rebellion was being settled, and the rebels were being dispersed, at Montgomery's Tavern, north of Toronto, Duncombe was on the march, on his way to join Mackenzie, and expecting that his small force would be swelled as he proceeded. On his arrival at the village of Scotland, half way between Norwich and Brantford, Duncombe learned of the defeat of Mackenzie and of the near approach of a Government force under the command of Colonel McNab. By December 13th, a week after the encounter at Montgomery's Tavern, the Middlesex Militia, under the command of Colonel John B. Askin, Clerk of the Peace at London, was on its way to join Colonel McNab. As these western volunteers approached the village of Scotland, they expected to be met with resistance from Dr. Duncombe. Instead they found McNab in occupation of the village. Duncombe had recognized the hopelessness of the situation, and had ordered his army to disperse.

In spite of their hasty dispersal, many of the rebels were overtaken and taken prisoner by the Government troops. About forty of them were captured at the bridge where the Talbot Road crosses the Otter Creek, near the village of Richmond (Bayham Post Office). Dr. Duncombe made his escape to the United States.

Colonel McNab's army was quartered for a year in the vicinity of Norwich. For some months the arrest of alleged and suspected rebels continued, and the trials for sedition and for treason dragged on for a long time. Considerable numbers of persons who believed themselves innocent of any such crimes took occasion quietly to avoid the risk of arrest, imprisonment, and trial, by slipping

across the border into the United States, some intending to return, others to make for themselves a new home in that country. One of those who went thus into voluntary exile was Samuel Edison, of Vienna.

The Edisons, descendants of a Dutch family, had, in 1730, settled in New Jersey, where they established themselves as bankers, and were possessed of considerable property. During the American Revolution, John Edison remained a loyal British supporter, and for that reason his fine home was burnt and his broad lands were confiscated. In 1783, he and his family were among the first to be transported to Nova Scotia, where he made himself a new home on the shores of the Bay of Fundy, near where Digby now stands. Through the influence of Colonel Thomas Talbot, John Edison, now well on in years, left his lands in Nova Scotia, and came in 1811 to settle at the site of Vienna. Samuel Edison was his grandson.

CHAPTER 8

TRANSPORTATION

1. ROADS

Before the days of recorded history in the Otter Creek Watershed, the natural travel routes were the streams and lakes; and through long usage there were added to these the man-made trails and portages of the Indians. As these had served the needs of the aborigines in their wars and in their hunting, so they also served as channels of access by which missionaries, explorers, surveyors, and pioneer settlers came into the wilderness.

When settlement began, one of the first requirements of the pioneers was an improvement in the means of communication. In laying out the townships, the surveyors were instructed to provide allowances for roads, generally one chain (66 feet) in width, along the township boundaries, along the "front" of each concession, and along the side-lines between every fifth and sixth lot. When, following such a survey, the settlers arrived to occupy their lots, they found the "road" consisting of a line of blazed trees through the forest. It was an important part of their "settlement duty" to clear half the width of the road allowance in front of their respective lots; and when they had done so, and all their neighbours had done the same, the road was "opened", but not yet improved. They now had at least an opening through the woods, more or less along a straight line, by which they could find their way on foot or on horseback from place to place, but without much of either ease or comfort. To cut the stumps of large trees down to ground level, or to such a height as would permit a vehicle to pass over the tops of them; to bridge the streams and causeway the swamps; to cut down the tops and fill the bottoms of the steepest grades—these were tasks to engage the attention of the Government, the appropriation of a large share of the public moneys, and the labour of the inhabitants in every part of the province.

The Talbot Road was intended to provide convenient communication between Talbot's Settlement and the seat of government at York (Toronto), and also to attract settlers along its extent whose duties would include the clearing of the road and making it passable for vehicles. This in turn would enhance the value of adjacent lots in the townships through which the road would pass, and make for more rapid and more compact settlement. The Talbot Road was

not to follow a fixed course, like a township boundary or a concession line, but was to be adapted to the conditions of the topography, to avoid the swamps and the hills, and to effect a workable compromise between directness of line and the most "eligible" ground. This involved a good deal of exploratory surveying before the course of the road was finally determined.

The earliest "improvement" of the roads was generally limited to the most necessary grading, the use of corduroy or other causewaying across the swamps, and the construction of bridges across the streams. The roads thus improved were still subject to seasonal hazards. They were at their best in summer weather and when, in winter, they were covered with enough snow to make good sleighing. By a variety of practices, introduced from time to time on an experimental basis, the roads were gradually still further improved. There came into use the gravel road, the Macadamized road, and the plank road.

In an area where a considerable proportion of the land surface is intersected with gullies and ravines, as is the case in much of the Otter Creek Watershed, the survey lines that determined the road allowances occasionally involved grades that were too steep for safety and convenience, the bridging of streams at awkward angles, and the traversing of swamps that could easily be avoided. At such places, a procedure was provided for making an alteration in the course of the road. A specified number of inhabitants, often given as "twelve or more", submitted a petition to the Court of General Quarter Sessions of the Peace for the District concerned; if the Court approved of the application, a surveyor of highways was instructed to make an examination of the proposed alteration and to report on the suitability of the ground for the making of the new road. The Court had further to authorize the acquisition by the Crown of the lands over which the new road must pass, and the disposal of the land, part of the original road allowance, to be abandoned by the alteration. Such roads, constituting a deviation from the lines established by a previous survey, varied in length from a few yards to several miles.

In 1851, the plank and gravel road was completed from Port Burwell to Ingersoll. This thoroughfare greatly facilitated the movement of timber and produce to the lake, being a main trunk line from north to south. The old village of Sandytown was in existence before this time on the lot taken up by C. Hunsberger, about half a mile west of the present village of Straffordville. This latter village, and the village of Eden, five miles farther north, both came into being as a result of the construction of the plank road.

When the plank road was newly laid, and in good condition, travel on it was pleasant and smooth; but there is evidence to show that, after the lapse of a few years, it was difficult to maintain the smoothness and the safety of travel once the planks were warped and worn, and dislodged from their proper alignment.

2. RAILWAYS

The early schemes for the incorporation of railway companies in Upper Canada included a few that contemplated railway lines running parallel to the shores of the two lower Great Lakes, Ontario and Erie: such were the Great Western Railway, the Erie and Niagara Extension Railway, and the Canada Air Line Railway. But the great majority of the railway companies

incorporated between 1834 and 1872 were designed to serve as local feeders, to transport goods and passengers to and from the lake ports that provided channels of access to points either east or west, or across the lakes to the ports of the United States.

(a) WOODSTOCK AND LAKE ERIE RAILWAY

A company was incorporated to construct this railway from Woodstock to Port Dover and Port Burwell in 1848. The operations of the directors were so riddled with "bad faith, deceit, reckless extravagance and misappropriation of moneys" that a select committee was appointed to investigate the company in 1857. No further serious attempt to complete the construction was ever made following the presentation of the committee's findings.

(b) PORT DOVER AND LAKE HURON RAILWAY

Fifteen years after the death of Mr. Zimmerman (its chief promoter in 1857) and the consequent cessation of efforts to promote the Woodstock and Lake Erie Railway, a new company was incorporated, and by 1876 was in operation, to a large extent following the line that had been projected for the former road.

An Act to incorporate the Port Dover and Lake Huron Railway Company was passed in 1872, and received Royal Assent on March 2nd of that year. The Act provided for the laying out and construction of a line of railway.

The line of this railway is shown in the Historical Atlas of Oxford County, 1876, and the similar Atlas of Norfolk County, 1877, passing from Port Dover, through the Town of Simcoe, across the Townships of Windham and Norwich, to Woodstock.

(c) ERIE AND NIAGARA EXTENSION RAILWAY
(CANADA SOUTHERN RAILWAY)

The Act for the incorporation of the Erie and Niagara Extension Railway Company was passed in 1868, and on December 24, 1869, the Act was amended, and the name of the company was changed to "the Canada Southern Railway Company". One of the townships that aided the construction of the Canada Southern Railway was South Norwich, the by-law for that purpose being passed on October 9, 1870. The line of the Canada Southern crossed the township from east to west entirely within the limits of the eleventh concession, and later became the line of the Michigan Central Railroad.

(d) CANADA AIR LINE RAILWAY

This was another east-west railway, one of the few that were designed to operate along a line roughly parallel to the shores of Lake Erie. According to the Bayham Township Centennial Souvenir Book, 1850-1950, by 1871 this line of railway had been completed from St. Thomas to Tillsonburg, passing through the village of Corinth. In the Atlas of Norfolk County, 1877, The Canada Air Line Railway is shown as passing through Courtland and Delhi, in the Township of Middleton. The line subsequently became part of the Canadian National Railways.

(e) PORT BURWELL AND INGERSOLL RAILWAY

This was one of the numerous railways incorporated by statute assented to March 2nd, 1872. The line of its construction was indicated in the following section of the Act:

"The company shall have full power under this Act to construct a railway from any point in or near the Village of Port Burwell running north to a point in or near the Village of Tilsonburg, and thence to the Town of Ingersoll, with power to extend the same to the Town of St. Marys."

It is not clear to what extent this railway was in whole or in part identical with the Tilsonburg, Lake Erie and Pacific Railway, discussed below. The line in later years became a part of the Canadian Pacific Railway.

(f) THE NORFOLK RAILWAY (BRANTFORD, NORFOLK AND PORT BURWELL RAILWAY)

On March 24, 1874, the corporate name was changed to the Brantford, Norfolk and Port Burwell Railway Company, and the line of its proposed construction was extended to include a route through the Townships of Burford, North Norwich, Dereham, Middleton and Bayham, and to pass from Brantford, through Tillsonburg and Vienna, to Port Burwell. Nevertheless, the section of this railway that was to have connected Port Burwell with Tillsonburg was never completed. The free excursion that, in 1875, celebrated the completion of the road from Brantford to Tillsonburg marked, for all practical purposes, the end of construction of the Brantford, Norfolk and Port Burwell Railway.

(g) TILSONBURG, LAKE ERIE AND PACIFIC RAILWAY

The agitation for this railway started in 1875 and continued for 20 years.

In addition to other forms of assistance contributed by various municipalities the Township of Bayham had, on March 6, 1893, passed a by-law to authorize the transfer of the Port Burwell harbour to the railway company. The time allowed for the completion of the line, set originally for December 31, 1892, was extended "until the thirty-first day of December, A.D. 1895", the date when, according to the Port Burwell Centennial Souvenir Book 1930, "the first train arrived in the Port".

Of the seven railway companies whose lines have served the watershed with which this report is concerned, not one has retained its individual incorporation, direction, and management. All have become part of one or another of the two great Canadian railway systems and the one non-Canadian line which, in 1957, continue to serve the communities in the Otter Creek Watershed.

The "McCurdy" Mill, Lot 113, North Talbot Road, Bayham Township about 1925.

2 LAND

GEOGRAPHIC ASPECTS OF THE OTTER CREEK WATERSHED

1. INTRODUCTION

The Otter Creek valley extends north from Port Burwell a distance of 29 miles and comprises an area of approximately 316 square miles, or 202,200 acres. The valley is drained by the Otter Creek which debouches into Lake Erie at Port Burwell. Its chief tributary is the Little Otter Creek which enters the main stream about 6 miles north from the lake. Another stream, also known as Little Otter Creek, is included within the Authority but it drains independently into the lake on the eastern outskirts of Port Burwell.

From the northern boundary, in the moraine north and west of Norwich, the land drops from an elevation of about 1,050 feet to about 575 feet at the lake. At the lake there are steep bluffs up to 100 feet high. The regional slope of the sand plain south from Otterville and Tillsonburg to the top of the lake bluff is quite low; in many places the landscape appears almost level.

The watershed includes a number of municipalities—parts of the Counties of Norfolk, Oxford, Brant, Elgin and Middlesex and portions of twelve townships. The chief towns and villages are those of Tillsonburg (6,016), Norwich (1,547), Port Burwell (688), and Vienna (335). In addition there are a number of police villages and hamlets such as Otterville and Bayham.

2. BEDROCK GEOLOGY

Throughout the watershed the bedrocks are covered by thick deposits of unconsolidated materials—the older tills, Wisconsin drift, stratified sands and gravels, and lacustrine clays and silts. These deposits may be up to 100 feet or more deep in the north and up to 250 or more feet thick in the vicinity of Port Burwell. At no point is the bedrock exposed.

The limestones underlying the region belong to the Delaware and Detroit River—Onondaga Oriskany formations. Because of their great depth below the surface these rocks are of little importance except in one respect; some of the artesian waters are sulphurous, especially those coming from the Delaware rocks, and may be unfit for human consumption although quite suitable for stock-watering, certain industrial purposes and even irrigation. The water supply in the top few feet of the rock may be potable but polluted by mineral materials at greater depth.

3. CLIMATE

Most of the Otter Creek Watershed lies within a climatic region called by Putnam and Chapman the "Lake Erie Counties". Nearly all of the sand plain and the southern portions of some of the moraines lie within this region. The northern section of higher elevation belongs to the region described as the "South Slopes".

There is some correspondence between the northern boundary of the Lake Erie Counties region and that of Halliday's Deciduous Forest Region. The latter notes that this region, because of favourable climatic and soil conditions, allows "for the sole distribution in Canada of many Deciduous Forest species".


PHYSIOGRAPHY
— LEGEND —
SAND PLAIN
UNDRUMLINIZED TILL PLAIN
TILL MORAINE
SPILLWAYS
MUCK
CLAY PLAIN
COMPLEX OF CLAYS, TILLS AND ERODED MATERIALS
DRUMLINS
SHORELINES
S C A L E — M I L E S
1 0 1 2 3 4
MAP BASED ON DATA FROM "CHAPMAN AND PUTNAM, PHYSIOGRAPHY OF SOUTHERN ONTARIO", AND SOILS REPORTS OF ONTARIO SOIL SURVEY; (NORFOLK, ELGIN AND OXFORD COUNTIES)
L.E.C. CONSERVATION AUTHORITIES BRANCH 1962 O.K.
ST. THOMAS MORAINE
NORWICH MORAINE
TILLSONBURG MORAINE
TILLSONBURG MORAINE
LAKE ERIE

He also observes that "a large number of these species . . . find their northern limit here".

There is perhaps no particular climatic control governing the growth of agricultural crops from one region to the other but there is no doubt that for some crops at least some varieties will fare better in one zone than in another. Length of time to maturity, length of frost-free season and length of growing season are important factors respecting variety suitability. Crop varieties should be selected with reference to climatic conditions in order to obtain the best yields. Thus, at least one crop, peaches, is restricted to the lakefront, chiefly because of the more equable climate found there.

4. PHYSIOGRAPHY

During the past million years Southern Ontario has been covered at least three times by major continental glaciers. The last of the ice, that of the Wisconsin glaciation, vanished from the Otter Creek area perhaps 15,000 years ago. Each of these three major ice advances and recessions was marked by many minor, often local, fluctuations in the ice front.

Nearly all of the present-day topography is the direct result of the activity of the Wisconsin ice sheet, and particularly of the fluctuations affecting it before it finally withdrew. Coincident with the ice recession, resulting from a general climatic warming, there came vast outpourings of meltwaters. These were dammed up, partly by the as yet unmelted ice and partly by new lines of hills created by the ice, to form extensive glacial lakes. These lakes were important in the creation of extensive level plains of sand, clay and silt which are common over much of Ontario.

So far as present-day topography is concerned the glaciations of pre-Wisconsin Age have little importance in the Otter Creek area, although there is evidence that some of the present moraines are remodelled pre-Wisconsin deposits. Also, some of the heavier tills are undoubtedly reworked lacustrine clays and silts.

These early till sheets are important with reference to the water supplies of south-western Ontario. Most of the drinking water comes from the beds of stratified sands and gravels which lie between the layers of till. Good sections of these old till sheets and their stratified interbeds may be seen in the lower valley of the Otter Creek.

In the Otter Creek region several types of glacial landforms may be recognized: till plain, till moraine, spillways and drumlins. There are also landforms resulting from the glacial lakes: sand plains, clay plains, sand dunes and shorelines. Finally there are the post-glacial developments—the present drainage pattern, the peat and muck deposits, the steep receding bluffs cut by Lake Erie, and the present variety of soils.

During the general retreat of the ice sheet the Erie lobe (occupying and spreading out from the Lake Erie Basin) was probably of most importance in building much of the scenery of the watershed. Over a period of time it advanced and receded several times, from and to the general area of present Lake Erie, and in the course of these advances or retreats constructed several moraines.

These moraines are long, knobby ridges built up of till, an unconsolidated, unstratified mixture of clay, sand and irregularly shaped stones and boulders. The till of a moraine may range from coarse and bouldery to heavy and largely stonefree. The morainic deposits within the watershed are chiefly of the latter type. The irregularly-shaped depressions between the knobs are frequently poorly drained and may contain peat or muck deposits.

There are three moraines within the watershed: the St. Thomas (Mt. Elgin Ridges), the Norwich, and the Tillsonburg. Associated with the first two is an extensive network of spillways, the drainage channels formed by the vast amounts of water pouring off the melting ice. These valleys may be quite wide, are often poorly drained, have sandy and gravelly soils and are often best used as forest land. They may or may not contain small streams at the present day.

The soils of these moraines have been mapped by the Ontario Soil Survey as belonging to the Guelph and Huron catenas and these are discussed in the section of this report relating to soils. The former is considered to be a medium-textured till and is somewhat stonier than the Huron, a soil developed in heavy-textured till. The well drained members of both catenas are fairly fertile but subject to erosion. They are unsuitable for flue-cured tobacco but good for dairy and beef farming and some cash crops. In many places there is an abrupt change in the cultural landscape as one passes from the sand plain into the moraine or till plain.

The till plain is confined to the north-west section of the watershed and the general aspect is similar in many ways to that of the moraines. The topography is more subdued, however, and the slopes are longer and not as steep. Drainage imperfections are often widespread. A till sheet is formed under a moving mass of ice, rather than along the perimeter of a lobe as is the case with a moraine. In this area the land uses are much like those of the moraines, but there is, perhaps, more emphasis on cash crops, and also some orchard development. Perhaps the chief conservation problem of the till plain is that of drainage improvement.

Drumlins are oval hills formed out of till under a moving ice mass. Locally they may be called whaleback hills or hogsbacks. In Ontario they are found in great fields and are common to the till plains where loamy soil materials predominate. The heavy till plain of the watershed is undrumlinized but several drumlins are found in the extreme north-west corner of the watershed. These are peripheral to the Woodstock drumlin field.

The soils of a drumlin are usually quite fertile but may be stony. The moderately to steeply sloping land is subject to severe erosion unless well managed. Where drumlins are numerous the land between them is often wet and suitable only for forest or pasture.

With the creation of the large glacial lakes a good deal of the present Otter Creek Watershed was under water. Two of these lakes, Whittlesey and Warren, are of particular significance with respect to this area. At the time of Lake Whittlesey the present Lake Ontario basin, the Niagara peninsula, and the eastern portion of the present Lake Erie basin were ice covered. The Huron lobe overlapped the boundaries of the present Huron basin, and the central portion of Western Ontario was dry land. As the ice melted vast amounts of water poured

Short, steep slopes and irregular topography are found on the moraine. Winter cover crops, extended rotations and grass will help control erosion on land like this.

The till plain is marked by gently sloping land and restricted drainage and sheet erosion can be serious. Rotations and contour tillage can provide effective erosion control.

south down the spillways through the Guelph and Brantford areas. The waters carried immense amounts of sand which were deposited in the lake as a delta to form, subsequently, the Norfolk sand plain. A large volume of sand was also deposited in Lake Warren. Portions of some of the moraines were wholly or partially buried by the sands.

These sands are not rated highly for dairying or general farming because their inherent fertility is low, they are inclined to be droughty after the end of spring, and because of the low organic content and the rapidity with which nutrients are leached out. When regularly cultivated and not protected they become subject to wind erosion. Their failure to return an adequate income for the labour and money expended, and the considerable wind erosion in some areas, led to an extensive program of reforestation after 1908. Thousands of acres were thus treated over the years and include provincial and county forests and many small private plantings. The Otter Creek Conservation Authority should continue this program.

Although the soils of the sand plain proved unsatisfactory for productive dairying or general farming those which were well drained proved eminently suitable for the production of bright leaf tobacco. These soils were so suitable, in fact, that this crop in 1954 ranked second in gross value in Ontario after hay and clover, and used 120,804 acres of land. Because of drought, disease and frost the 1955 crop was smaller. Not all of the crop is produced on the sands in the Norfolk area, of course, but by far the largest amount is grown there.

The sands have also proved suitable for the production of peaches, particularly along the lakefront where extensive orchards are situated. Local climatic amelioration, induced by the lake, is undoubtedly a factor in this development.

The open nature of the sand leads to a rapid infiltration of precipitation and also to good movement of the groundwater. The underlying clays and tills (the sands may be a few inches to 60 or 70 feet deep) provide an impermeable layer and produce a fairly high watertable. As a result of this, good water in fairly plentiful supply is easily obtained.

Although the sand is coarse textured not all of it is by any means well drained. Many thousands of acres are imperfectly or poorly drained and the land is generally not suitable for the production of tobacco or orchard crops. A large portion of this land is covered by unimproved forest and poor scrub and, where cleared, is often left idle. Some of the land is used to pasture the horses necessary in tobacco harvesting.

So long as tobacco continues to be the major agricultural occupation of the people on the sand plain, so too will this pattern persist. Under the circumstances it would be well if the present forest cover on these lands was managed, and the poor scrub and idle lands reforested. The Otter Authority can play a major role in the improvement and rehabilitation of these lands.

The glacial lakes persisted for some time and as a result there developed wave-cut bluffs, beaches and off-shore bars. These features are like those found on the shore of present Lake Erie but are not usually as well developed. A beach and bluff may be found around part of the moraine immediately north of Tillsonburg

and others may be seen south and west of the town, again in the moraine. Another set crosses the watershed in an east-west direction just south of Straffordville. Deposits of gravel and of larger stones are often found with the beachlines, particularly where the waves cut into the tills on the moraines. The lack of substantial deposits reflects, however, the stonefree nature of the heavy tills. These sites are at times useful for the commercial extraction of gravel, as are the spillways.

There are also many dunes through the area. The more extensive, belt-like developments relate to the glacial lakes in all probability but it is certain many of the smaller ones have developed since, particularly after settlement and land clearing when the light, unprotected soils were allowed to blow. Most of the dunes are unsuitable for cultivation and are best covered by trees and permanent grass. Many have been reforested.

In addition to the till plain and clay moraines there are two other areas of heavier soil on the watershed. One of these is the clay plain in the vicinity of Bayham. The other is contiguous to this plain and extends from it along both sides of the river to the mouth. It is highly likely the latter is, to a considerable extent, the result of erosion stripping off the former sand cover and laying bare the heavier subsoils. Many tributaries enter the stream along this part of its course and severely eroded slopes are common. The steeper of these should be reforested, either privately or with Authority support. It should be recognized, however, that the nature of the soil material and the steepness of the slopes might combine to make successful planting difficult.

A spectacular feature of the watershed is the river valley itself. In its upper reaches it is little different from any other, but the lower portion is deeply incised in the near-level plain. The deep valley of this and adjacent streams has had considerable influence on the road system. Bridging these cuts would be difficult and the expense of so doing prohibitive. Where roads have been continued through the valleys they are often tortuous and steep.

There is a significant relationship between the river and the soil materials through which it and its tributaries flow. Examination of the map relating to stream flow reveals the fact that most of the permanent flow originates in the sand lands. The tributaries drying up completely in summer, or to standing pools, are those whose watersheds are mainly or wholly in the areas of heavier soils. Most of the streams in the north-west portion of the watershed are dry through part of the summer. The same is true of the streams entering that portion of the river flowing through the moraine south of Tillsonburg. The clay lands upstream from Vienna show a similar development.

The physiographic feature which may be considered finally is that of the present lakeshore. The bluffs developed in the unconsolidated materials are nearly vertical and up to 100 feet high. They were cut by the wave action of Lake Erie and the recession of the shore is continuing. Since about 1810 the section between Port Burwell and Long Point has receded up to 1,200 feet. Recession of the shore at the Houghton Sand Hills appears to have been less, about 600 feet. In many places the bluff has been notched by deep gullies and these are a continuing problem; they take land out of production and are a hazard to existing roads.

CHAPTER 1

LITTLE VALLEYS

1. INTRODUCTION

An investigation of land conditions on one of the tributary valleys of Otter Creek was made part of the conservation survey.

2. LITTLE VALLEYS

To simplify the task of the Authority and to bring the desired results more rapidly it is often desirable to select one of the tributary valleys for improvement. For this and other reasons, the Branch Creek Valley (it may be better known locally as Sweet Creek) was selected for study. In a smaller valley of this kind co-operation may be achieved more easily because of the smaller number of people involved and because the limits and condition of the area are better known to them.

While the ultimate goal is the improvement of the valley as a whole, with every farmer and other land user co-operating with the Authority in its efforts, the success or failure of the project depends on the individual farmer. He is the one responsible for the improvement of his own farm. He is also the one who has to cope with the unique conditions found on his farm. Nevertheless, the responsibility for initiating and furthering the plan belongs to the Authority. It can contribute a great deal by helping to bring to the farmer the information he needs to help him grow better crops and improve the condition of his land.

3. SOIL AND WATER CONSERVATION

On the Branch Creek nearly 95 per cent of the land has been considered capable of sustained cultivation but less than 2 per cent of it is capable of being used without restriction in its present condition. Some of the land, with adequate drainage, can be considered the equivalent of Class I land and used to capacity without other special measures. Most of the sloping land will always be subject to use restrictions if no damage to the land is to result.

4. THE BRANCH CREEK DRAINAGE AREA

The Branch Creek is a small tributary of the Otter Creek which it joins at Otterville. It runs in a south-east direction to this point for a distance of about 6 miles. The area drained by the stream is about 7,340 acres and lies within the townships of North and South Norwich in the County of Oxford. The next nearest settlement of any size is that of Norwich which lies to the east of the watershed a distance of about 1 mile.

The watershed is well served by roads and a rail-line connecting Norwich and Tillsonburg crosses it.

Most of the creek is dry for part of the summer or dries to standing pools. Only in its lower reaches is permanent flowing water found.

5. HOW THE VALLEY WAS SURVEYED

During 1955 several crews were engaged in the survey of the valley. Each crew was allotted a portion of the watershed and all the land was covered on foot with visits being made to every field.

During the survey a number of observations were recorded, the data being plotted on air photographs of the area. These show the field pattern, the field boundaries, extent of woodlot and so on, and their use greatly facilitates survey work of this nature. All land uses for the crop season of 1955 were recorded on the photograph by means of appropriate symbols. In the same manner physical land conditions were mapped to a minimum of four acres. These included the delimiting of soil types, an estimation of erosion, the slope of the land, the degree of stoniness or boulderiness, and the extent and size of gullies. The locations of waterbodies, watercourses, springs, seepage areas and drainage ditches were noted.

With the completion of the survey the information obtained was transferred from the air photographs to vellums and the various acreages assessed by planimetering. From the data gathered regarding present land use and physical land conditions the capability of the land was appraised. This is expressed in the map of Recommended Use which accompanies the report.

CHAPTER 2

PHYSICAL LAND CONDITIONS

1. INTRODUCTION

A few remarks on the physiography of the little valley may be made here for this has bearing on the use of the land, water supply and other matters.

2. PHYSIOGRAPHY

The bulk of the watershed lies in an area of till plain in which the soils are fairly heavy, rather stonefree and, over a large acreage, suffer impeded drainage. There are a number of irregularly-shaped, low-lying areas where drainage is poor. Some of these low areas contain small deposits of muck. The largest area of muck to be found on the watershed lies at the headwaters in the northern portion of the till plain. The muck is up to 4 feet deep and presumably resulted from a fairly long ponding of water backed up in a hollow behind the moraine. This muck area is now drained by Branch Creek and in the summer of 1955 was dry to the bottom.

In general the landscape of the plain is gentle and the slopes are long and smooth or mildly hummocky. Doubtless the surface till at least has been created out of the stonefree, heavy lacustrine sediments which the Erie ice lobe worked over prior to the formation of the sand plain. Varved silty clays and clays may be seen along the edge of the till plain underneath the sands north of Otterville. It seems probable that varved sediments underlie at least portions of the surface till of the till plain. If so, these heavy sublayers might have an adverse effect on soil drainage.

The Norwich moraine runs more or less east-west across the watershed and bisects the till plain in this area. The local topography is rougher than that of the till plain but not excessively so. The greatest topographic break is found where the Branch Creek cuts across it and the valley here is quite large and deep. It would be difficult to say whether this is completely an excavation of the Branch Creek or simply an expansion of a trough through the moraine by the stream. In general the soil materials are somewhat lighter than those of the till plain. The medium-textured Guelph soils are common here but there is also some Huron.

The soils are also stonier. Dairy is the main pursuit and there is little cash cropping apart, perhaps, from grain corn.

The Branch Creek Valley is largely outside of the sand plain but the lower rim of the watershed lies within it. Some of the sand is a thin veneer a few inches to a couple of feet thick, and a good deal of it is imperfectly to poorly drained. Where the sand is deep the soil drainage is usually good to excessive. Tobacco growing has entered the watershed on the better drained land near Otterville.

3. SOILS

(a) *The Soil Profile*

There is infinite variety in soil and a very large number of types may be recognized. As knowledge of soil grows there is a tendency for the types recognized to increase in number. Each soil recognized has certain identifiable characteristics which set it apart from others.

Soils are classified and mapped on the basis of these natural characteristics, which may include such things as the number of horizons in the profile and the colour, texture, structure, organic content and reaction of each. Among other things the nature of the subsoil and the degree of stoniness or boulderiness will also be considered.

A soil develops out of the original parent materials and the type resulting depends on the inherent characteristics of these materials, on the climate, surface slope, and the surface and subsurface flora and fauna. Other factors may also be of importance. In any single instance all of these factors operate together and interlock in such a way that, if undisturbed or unchanged to any marked extent, they produce, in time, a soil possessing certain recognizable characteristics. Because the conditions which operate to create them are dynamic, soil profiles, and consequently the soils themselves, are constantly changing. Usually these conditions change slowly and so the soils themselves change equally slowly.

If a vertical cut is made to a depth of three or four feet through the soil it will be seen that the cross-section is marked by a layering, each layer, or HORIZON, possessing certain characteristics of colour, texture, structure, organic content, and acid reaction. Together these horizons make up the soil PROFILE. The depth of the profile is variable, in some soils a foot or less and in others several or many feet. On the Branch Creek Watershed the profiles are usually two feet or less in depth. In the moraine they may be somewhat deeper and in the sands, particularly those which are well drained, somewhat deeper still. The Fox may be three feet or more to the bottom of the B horizon.

Depending on drainage conditions several distinct types of profile may be found. The following is a generalized description of a virgin, well drained Gray-Brown Podzolic soil such as might be found in an old woodlot or along a fenceline in the Branch Creek Watershed.

HORIZON

Ao—Partially decomposed litter from deciduous trees.

A_1 —Dark grayish-brown to very dark brown mineralized humus layer—loose and friable and slightly acid in reaction.

A well developed Fox profile near Otterville. The A2 horizon is the broad, light - coloured band running between the darker A1 and B horizons.

Gullies cut back through the stream bank in many places. Areas such as this should be fenced and re-forested.

A_2 —The leached horizon, yellowish to yellowish-brown to gray in colour. The iron, lime, organic matter and clay have been washed out and the reaction is acid.

B —The horizon of accumulation, containing a high proportion of clay and sesqui-oxides. Usually the colour is dark or reddish-brown while the structure is blocky or nutlike. In reaction it is usually neutral to slightly acid but the lower portion of the horizon may contain some free carbonates.

C —The unweathered, calcareous parent material, usually gray or brownish-gray in colour.

When speaking of the soil horizons the A is considered to be the topsoil, the B the subsoil, and the C the parent material. In a poorly drained soil such as the Brookston, or the Parkhill, the A_2 and B horizons may be missing or poorly developed and a G (Glei) horizon exhibited. The latter is often blue or blueygray in colour and marked by rusty mottling.

(b) *The Soils of the Watershed*

Nearly all of the soil materials in the watershed were laid down during the period of the last ice age. These parent materials consist chiefly of heavy till but there is also some acreage of medium till and, of course, of sand.

A group of soils developed on the same type of parent material and possessing similar horizon development and characteristics is classed as a soil series. Type differentiation within a series is based on the texture of the surface soil. There is thus a Huron clay loam and a Huron silt loam. Huron indicates the soil series and, with the exception of the texture of the surface soil, these two soil types have the same differentiating characteristics.

Where soils have developed on similar parent materials but differ in profile characteristics due to drainage or relief, then classification may be done on the basis of the catena. In terms of drainage there may thus be three series in the catena: the well drained, the imperfectly drained, and the poorly drained. In the Huron catena the Huron series is the well drained member, the Perth series the imperfectly drained member, and the Brookston series the poorly drained member. All of these catenary members are found on the watershed. For convenience a catena is usually identified by the name of the well drained member.

The largest acreage of soils in the watershed belongs to the Huron catena; in fact, these soils occupy about 4,300 acres, or 59 per cent of the area. A large part of the balance is taken up by the soils of the Guelph catena, the Fox catena, the Bookton catena, and muck and bottomland. The table summarizes the situation found on the survey.

(c) *Soil Erosion*

Under natural conditions the face of the earth is masked by a cover of vegetation and it is this cover which is chiefly instrumental in retarding run-off and slowing down erosion by wind and water. Because of the slow rate of erosion the soil, as seen in the profile, is not greatly affected by it and the process of soil building is easily maintained. While conditions remain more or less the same the loss of a fragment of surface soil is offset by an increment from below as the parent material weathers and is incorporated into the soil. Under conditions such as this nature is, by and large, in balance.

Soils			Soil Drainage	Parent Material	Acres	Total Acres	Per Cent	Total Per Cent
Catena	Series	Type						
Huron	Huron	Clay Loam	Good	Heavy Glacial Till,	265		3.6	
	Perth	Clay Loam	Imperfect	Low in Stone	3,995		54.4	
	Brookston	Clay Loam	Poor		37	4,297	.5	58.5
Guelph	Guelph	Loam	Good	Medium Glacial Till,	504		6.9	
	Listowel	Loam	Imperfect	Mildly to Moderately Stoney	1,639		22.2	
	Parkhill	Loam	Poor		21	2,164	.3	29.4
Fox	Fox	Sand	Good	Well Sorted, Coarse Textured Outwash Sand	202		2.7	
	Brady	Sand	Imperfect	May be some Gravel	401		5.5	
	Granby	Sand	Poor		41	644	.6	8.8
Bookton	Berrien	Sandy Loam	Imperfect	Coarse Textured Outwash Sand, Shallow (to 3 feet) over Clay	15	15	.2	.2
Muck—Varying thicknesses of organic soil over clay, silt or sand—may be woody or not, depending on source vegetation—drainage poor.					96	96	1.4	1.4
Bottomland—Often flooded—no profile development—variable composition of sand, silt or clay and gravel—drainage usually imperfect to poor.					126	126	1.7	1.7
Totals						7,342		100.0

When the land is cleared for cultivation or used for grazing, however, this picture may be greatly changed; the protecting cover of vegetation is removed or reduced; cultivation may be carried on up and down the slope and surface water enabled to flow over the land more easily; the structure of the soil changed for the worse and organic content lessened with the result that the soil's moisture absorptive capacity is impaired. All of these changes can easily produce, in a rather short time, a less productive or even a ruined soil.

Many measures may be adopted to control run-off and reduce erosion. Land kept under a permanent cover of grass or trees and properly managed may erode very little. The same may be true on level lands regardless of the form of use, although, of course, the land may become less productive unless soil management practices are adequate. Soil-building rotations, the use of cover crops and fertilizers, contour tillage and grassed waterways are among the measures that may be used.

(d) *The Estimation of Erosion*

There are a number of ways of determining whether erosion has taken place and the amount. The effect of erosion may often be easily seen in poor crop response due to drought. On slopes or knolls where the A and/or B horizons have been removed, the soil is less able to absorb moisture, and the crop may be thin and weak. Where erosion has been severe, the grayish parent material may be seen at the surface. A patch with an excessively stony surface may also be a sign of severe erosion and reflect the removal of the finer soil constituents. Erosion of this severity is relatively rare on the watershed.

Where observations such as this may be made, other evidence is also usually available: sediment may be seen to have accumulated at the bottom of a slope; soil may accumulate on the uphill side of a fencerow, while the downhill side is cut away.

To get a more certain determination of the degree of erosion the soil profile must be examined. It is usually possible to find a good profile of a virgin or nearly undisturbed soil in woodlots and along old fencerows. Such a profile may, for instance, exhibit one foot of topsoil (A_1 and A_2) and two feet of subsoil (B). On an adjacent cultivated slope of the same soil type and on which erosion is suspected, there may be only 6 inches of topsoil over the subsoil. In such a case it would be fair to assume that something like 6 inches of topsoil has been eroded away. In another case one might find the subsoil exposed at the surface and the parent material at a depth of only 12 inches. All of the topsoil and one half of the subsoil, something like 2 feet of material, would thus have been removed.

(e) *Soil Erosion on the Watershed*

Because of the overall gentle topography, and partly because of a fairly heavy emphasis on grass as a form of land use, soil erosion on the watershed is not as severe as it might otherwise be. The strong development of dairying and the large amounts of manure provided have undoubtedly served to slow down erosion and at the same time maintain the soil organic content.

Ninety-six acres were classed as muck and 126 acres as bottomland. No attempt was made to estimate erosion for these types and in many cases they were receiving material eroded from surrounding slopes rather than losing it.

(f) *Soil and Surface Drainage*

The lack of adequate soil drainage is one of the most important features of the area and a large area is affected. To gain relief so that the land may be worked more easily and a better yield obtained it is essential that such land be drained artificially. To a considerable extent this has been done and there are numerous open drains and tile underdrains. An expansion of this program is indicated, and is taking place, except on land where the cost of draining would be out of proportion to the benefit gained.

It is unfortunate indeed that the act of draining the land for crop improvement should lead to a greater deterioration of stream flow with respect to suitability for fish and, perhaps, for recreation. Agriculture is and will continue to be the major form of land use in this area and there will be an added emphasis on drainage in the years to come. The net result of more and more efficient tile and open drains will be to deliver water off the land at a faster rate.

The inability of crops to grow and produce on land with restricted drainage is due primarily to two things. In the first place the crops grown in the watershed are constitutionally unable to grow in water or in a water-logged soil. Secondly, although seeds may germinate, the roots develop and the plants begin to grow in the drier zone above the water-table, their later growth may be restricted by drought. This is because the plants cannot root deeply in the early, wetter part of the season. As the drier, hotter summer comes on the water table drops, sometimes quite rapidly, and the crop is starved for water because of the shallow root development. Too, the heavy soils, such as the Perth and Brookston, become hard and resist root penetration as they dry out.

CHAPTER 3

LAND USE

For perhaps one hundred years dairying has been the chief agricultural pursuit over most of the Branch Creek Watershed. In the beginning the family supplied its own requirements of dairy products but excess production soon found its way to market. By 1850 much of the surplus milk was being converted into butter and cheese, both of which were made at home. At this date Oxford County was producing cheese in fairly large quantities. The home product generally proved to be commercially unsatisfactory, however, and in 1864 the first cheese factory in British North America was established in Norwich. The number of cheese factories increased rapidly throughout the country and a fair share of them were in Oxford County. Thus the dairy farmer had an established market for the product from his herd.

The climate and soils of the County were well suited to dairying and once established the industry persisted. The County is now one of the two chief dairy areas of the province but the emphasis has shifted from cheese to whole milk. Much of the Branch Creek production is shipped to Toronto.

There is little doubt that the long association with dairying has helped to maintain the soils of the watershed. Improvement and expansion of the herds has

resulted in the production of more manure for the fields and has produced an emphasis on good pasture. Most of the pasture is improved but some, particularly that in the bottomlands, remains unimproved because of the natural land conditions.

Although most farmers are engaged primarily in dairying, a considerable number have devoted all or part of their land to special crops. Tobacco is the most important of these and in 1955 248 acres were being used for this crop. Its growth is restricted entirely to the southern portion of the watershed where are found the sands suited to its production. The next most important crop is millet which is grown for bird seed. One farm accounts for about half the acreage. The millet, white beans, soy beans, peas, sugar beets and turnips are all produced on the heavier soils. The commercial orchards are also on these soils.

In terms of acreage the chief crops on the watershed are hay, pasture, grain and corn. There is some grain corn but most of this crop is used for ensilage. There is nearly three times the acreage in spring grain as compared to winter grain and over half the grain acreage produces oats. The next important crop is winter wheat followed by oats—barley. Winter rye is largely confined to the tobacco land where it is important in the rotation as a cover crop and manure crop for maintaining the soil organic content. Rye is the most widely used rotation crop in the tobacco lands of the Norfolk sand plain. It is sometimes used preceding corn.

Most of the watershed suffers from poor or imperfect soil drainage and on most farms, if not all, some attempt has been made to improve the condition. A considerable amount of tile drainage has been installed and a number of ditches have been built. Some of these are merely an improvement of existing watercourses. It is interesting to note that a full half, the northern portion, of the main stream has been improved as a municipal drain, both ditch and large tile.

At the present time there are 86 farms wholly or partly within the watershed and about 80 of these are engaged primarily in dairying. These holdings range in size from 25 acres or less to over 250 acres. Most are about 100 acres in size. In line with the general trend in Ontario it may be expected that the future will see fewer farms of larger size. There may be a greater lag here, however, than in those areas where the soils are less productive. The soils of the area are eminently suited to dairying and it is anticipated that this will continue to be the main endeavour. Cash cropping is important and may become more important in the future. These matters should be kept in mind with reference to any program relating to land improvement which the Authority might implement. In this regard it should be remembered that the watershed contains, basically, two distinct types of soil and three classes of land use and that these will have a bearing on the program followed.

Lately there has been an influx of Amish Mennonites into the watershed from Ohio. Several farms have been purchased by these people and it is likely that more will move into the area in time. In other parts of Ontario where this sect has congregated the result has generally been highly favourable in so far as the effect on land is concerned. They are good farmers and normally handle the land well.

Restricted soil drainage is common on the watershed. Tiling helps produce better crops and makes the land easier to work.

Where poor drainage persists the crop may be killed or fail to develop. Under-tiling soon pays for itself.

Drainage ditches are common in the Perth and Brookston Soils but many are trampled by cattle and filled with weeds.

The following table summarizes the present land use of the watershed.

PRESENT LAND USE

Land Use	Acres	Total Acres	Per Cent
Hay	972	972	13.3
Improved Pasture	1,353		
Unimproved Pasture	307	1,660	22.6
Grain — Spring	1,462		
— Winter	546	2,008	27.2
Intertilled Crops			
Corn	1,035		
Tobacco	248		
Turnips	94		
Sugar Beet	36		
Peas	35		
Soy Beans	19		
White Beans	7		
Potatoes	4	1,478	20.2
Millet	206		
Orchards	57		
Market Garden	22		
Idle	82		
Farmsteads, Etc.	165	532	7.3
Forest — Pastured	541		
— Not Pastured	109		
Forest Scrub — Pastured	41	691	9.4
Totals		7,341	100.00

CHAPTER 4

LAND CAPABILITY AND RECOMMENDED LAND USE

1. LAND CAPABILITY

Before land may be planned for use in a program of soil and water conservation, it is necessary first to classify it in terms of its use capability. Only by deciding the capability of the land for its proposed use can we be sure of using each acre according to its capability and managing it according to its needs. To get the most out of the land on a long term basis the appropriate crops, commensurate with need, should be grown, and good tillage methods adopted. We aim at retaining or improving soil fertility, tilth and organic content, and decreasing water run-off and soil erosion by improving the water absorptive capacity of the soil.

The classification of land for use depends on a number of things, including the use to which the land is to be put. The classification of land for, say, recreational or industrial purposes will require different criteria than for agriculture although some of the factors involved may be common to each. With reference to agriculture

it is necessary to know, for any particular place, the type of soil to be found there, the slope of the land, the degree of erosion, the state of soil drainage and the existence of gullies, stone-piles and stone fences. The present use of the land, the existence of drainage schemes, the climate and the history of land use, among other things, should also be known. Unfortunately, the same detail of information is not always available for each item but an effort is made to get as much as possible.

In classifying the lands of the Branch Creek Watershed, also, several questions were kept in mind:

(a) was the land suited to the production of crops found there and if so could it be tilled without the risk of erosion?

(b) if erosion was a restricting factor, how great a risk was entailed in devoting the land to continued cultivation?

(c) was the land capable of being used for cultivation only part of the time with minimum risk?

(d) was continued use limited to the production of permanent vegetation, and if so should the cover be grass or forest?

(e) how suitable was the land for the production of intertilled cash crops?

The capability of land for agricultural use may be rated in four main categories, each of which may, as follows, be subdivided.

A—Suitable for Cultivation—

Land Class I —Without any special practices.
Land Class II —With moderate restrictions in use and the application of more specialized conservation measures.
Land Class III —With more severe restrictions in use and the application of more specialized conservation practices.

B—Suitable only for Occasional Cultivation—

Land Class IV —Best used for permanent vegetation but may be cultivated with intensive restrictions.

C—Suitable only for Permanent Vegetation—

Land Class V —With no special practices or restrictions.
Land Class VI —With some restrictions in use or special practices.
Land Class VII —With severe restrictions in use or special practices.

D—Not Suited to Cultivation, Grazing or Forestry—

Land Class VIII—Includes areas of rock outcrop, and marsh. There is none of this class on the watershed.

Using all the available information, and the above classification, each piece of land may be classed and so designated on a map. This has been done for the Branch Creek.

2. THE LAND CAPABILITY CLASSES AND RECOMMENDED USE

The above capability classes may be converted into classes of recommended use by indicating which special practices and restrictions are required for each

type. The recommended classes are indicated by adding the symbols C, R or D to capability Classes II and III, and T and P to Class IV. Recommendations may be given as needed for Classes V, VI and VII. No special practices are required for Class I and normally no restrictions are placed on use. In some instances the land may be affected by more than one factor which would serve to influence the capability rating and also the recommended use. In such a case the more important factor is the determinant and the recommendation is made on the basis of it.

The symbol C is applied to land where the capability has been reduced through erosion which can be corrected by mechanical means such as contour tillage, diversion terraces, and strip-cropping. Land susceptible to erosion and capable of being farmed using these methods is also placed in this class.

Hummocky land and sloping land which is unsuited to contour tillage methods, although subject to erosion, drought, or fertility depletion, may be placed in Class R. Some types of level land may be also included. Vegetative methods of control such as rotations, winter cover crops, and soil building crops are indicated.

Wet land whose productivity can be improved by artificial drainage with minimum difficulty and expense is indicated by the letter D. Class III D requires more intensive drainage than Class II D.

Class IV land which is too rough or eroded to be put under regular rotation is indicated as IV T. Land which is too wet for regular rotations and on which artificial drainage is not feasible because of lack of outlet is classed as IV P. Normally suited as pasture land this class may, however, be cultivated and cropped in drier years.

3. RECOMMENDED LAND USE CLASSES

Class	Acreage	Per Cent
I	92	1.3
II C	306	4.1
II R	2,110	28.7
II D	3,748	51.1
III C	210	3.0
III R	54	.7
III D	401	5.5
IV T	45	.6
IV P	42	.6
V	216	3.0
VI	57	.8
VII	44	.6
TOTALS	7,325	100.0

With respect to prevailing land use and the state of the land as compared to the capability and recommendations there is relatively little difference. By and large the land of the watershed is being used wisely and well. There are, however, individual problems of sheet erosion, gully and rill erosion, fertility depletion and weed control which have to be met. Some land is being used too intensively with respect to capability and some is not being used nearly as intensively as it might be.

CHAPTER 5

CONSERVATION PRACTICES

1. INTRODUCTION

On the Branch Creek Watershed the practices outlined in this chapter may be used to advantage on most farms. Certain of them will not apply in some cases. Contour cultivation, for instance, will not be applicable on all farms simply because not all of them have land suitable for this type of tillage.

Conservation measures may be considered as being cultural or mechanical in nature. Cultural methods include such practices as extended rotations, improved pasture, and the use of green cover crops. The proper management of the woodlot may also come under this heading. Mechanical methods include drainage, farm ponds, contour ploughing and strip-cropping, terraces and grassed waterways.

2. CROP ROTATIONS AND COVER CROPS

A crop rotation means following a regular sequence of crops on a field with the same sequence repeated every several years. Cover crops are those crops which are planted mainly to protect or rebuild the soil.

A large part of the value of crop rotations and cover crops depends on their ability to rebuild the soil, protect it from erosion, maintain organic matter, add nitrogen and keep the soil in good tilth, and increase the amount of water absorption. Better crops are a result. Crop rotations and cover crops are, therefore, among the more important tools of the conservationist.

Crops may be classed as soil-building (the grasses and the legumes) and soil-depleting (grain, corn and root crops and other hoe crops). The latter group exhaust the soil most rapidly and expose it more readily to erosion and drought. The conservation farm planner arranges the cropping systems field by field, so that the land of lower capability, subject to erosion or already eroded has more of the soil-building and less of the soil-depleting crops. Land subject to serious erosion, or in that state, has the hoe crops excluded from it almost entirely. Under a suitable rotation the acreage of grain or hoe crops may be reduced but the yields maintained or even increased by making the land more productive.

On the tobacco lands at the south end of the watershed a two-year rotation of tobacco and rye is followed which has proved satisfactory for retaining the organic content, providing a cover crop and preventing wind erosion. This rotation is widely used throughout the tobacco belt of Norfolk and adjacent counties.

3. DRAINAGE

Often the natural drainage of the soil is insufficient to provide a good environment for the growth of most farm crops. Artificial drainage of its extensive imperfectly and poorly drained lands is a major conservation measure on the

Good land will continue to produce good crops if well managed.

A pear orchard with a ground cover of buckwheat. Other orchard crops are also grown.

Branch Creek Watershed. Much of this land has already been drained but much needs yet to be drained, or the present drainage system improved.

Drainage has two main advantages. First of all it makes soils of high inherent fertility capable of carrying the full range of crops that are carried on the well drained soils of the region. In addition, of course, the farmer is able to get on his land earlier than he might otherwise be able to do. Strangely enough, poorly drained soils can become seriously subject to drought. In the early, wet part of the season crops cannot root deeply while in the hot, dry season moisture does not move readily upward in the characteristically massive, poorly drained soils and the shallow-rooted crops suffer from drought.

4. IMPROVED PASTURE

There are many good pastures on the Branch Creek Watershed but at the same time there are some which can be developed to greater productivity. The fact that this region is near the heart of one of the two striking concentrations of dairy cows in Ontario no doubt explains the generally excellent development of pasture land.

A long-term improved pasture is one that is seeded to grasses and legumes and left for five years or more. It may be renewed by reseeding with or without the use of a nurse crop such as oats. Production of field crops is eliminated or kept to a minimum and as a result the soil is kept under a protective cover of soil-building grasses and legumes at all times.

5. CONTOUR CULTIVATION AND STRIP-CROPPING

Contour tillage entails the adoption of methods whereby the land is cultivated "on the level" along the contour and at right angles to the slope. The best slopes for this treatment are broad, smooth and not too steep. Satisfactory work may require the removal and/or relocation of one or more fencelines. Most farm fields in Ontario were fenced according to the rectangular survey grid and not according to the "lay of the land". When considered from the point of view of how to work the land best the need for fenceline adjustment is obvious.

When the land is tilled on the contour each furrow or drill row acts as a small dam to retain the run-off water which is better able to be absorbed by the soil.

Strip-cropping is often carried on in conjunction with contour tillage. This means the establishment of hay or pasture strips on the contour, and alternating with strips devoted to grains or intertilled crops. By the use of such a method any water which escapes from the cultivated strip, and which carries soil with it, is slowed down by the grass and the sediment is dropped. Strip-cropping has in mind mainly the reduction of water erosion. In the tobacco area to the south strip-cropping is common on the level and gently-rolling sands. The main purpose in this case is the protection of the land from wind erosion.

6. TERRACES

Terraces are broad, shallow ditches running across a slope with side grades gentle enough to allow implements to work over them. They may be cultivated or left in grass. Their purpose is to break a long or steep slope so that overland flow of water down the slope is checked, forced to penetrate the ground, and the surplus is diverted at lower speed across the slope. They have a slight downhill gradient, just enough to carry the water away. They empty surface water into a watercourse or structure in which it can be carried safely away.

7. GRASSED WATERWAYS AND DIVERSION CHANNELS

Many fields on the watershed have small channels crossing them which collect water from their own small watersheds in spring and after heavy rains and the rest of the time are dry. Nearly always these channels are cultivated with the rest of the field and no attempt is made to protect them.

These waterways should be planted to grass, should be wide enough to handle expected flow, and should be maintained. The banks of the waterway should be gently sloping and the grasses used should be those which will provide a thick, interlocking sod. Under management a waterway can provide substantial amounts of hay and pasture and aid in the delivery of clean water to the streams; the thick sod reduces the speed of the overflow and leads to the deposition of the silt load in the waterway.

8. FARM PONDS

In recent years there has been a considerable development in farm ponds in Southern Ontario and a large number have been built. At the forefront in support of this development have been the various Conservation Authorities.

An adequate water supply is essential on any farm although the amount needed and the use or uses to which it will be put will of course vary. In most areas the use of water is increasing and there is a continuing search for new or better supplies.

On most farms water is needed for domestic use and for stockwatering and the supply often fails or is much reduced in a dry year. With the increasing use of water for irrigation of special crops such as tobacco and fruits and the possibility of irrigating such crops as pasture a good water supply becomes an imperative need. Most often supplies of this order are unobtainable from ordinary wells and recourse must be made to ponds.

Farm ponds are excellent as a source of water for most uses and they may be designed quite readily to fit the needs of the farm. Too, the pond may be good for more than a single use as, for example, for orchard spraying, stockwatering, irrigation, recreation, fire protection and fish. When designing the pond the probable uses should be kept in mind.

CHAPTER 6

FARM PLANNING

To most farmers the idea of planning is not something new; in some measure or other they plan the use and management of their land so that they know a year or so in advance what cultivation sequence they are going to follow. They plan for repairs to buildings, equipment, fences and so on. They plan so far as they can the day to day and month to month work they are going to do, and much of it becomes routine. Planning, in short, is an essential feature in the life of the farmer as it is with anyone concerned about his future.

Although many farmers have a plan regarding the use to which they put certain or all of their fields, relatively few have had their farms planned so that the maximum use, consistent with the best use, is made of each piece of land. The object of a plan of this sort is to enable the farmer to get the most out of his land and at the same time to do it in such a manner that no damage to the land occurs.

The level, well-drained sands produce top-quality tobacco but require special cultivation practices to maintain fertility and reduce the risk of wind erosion.

Grassed waterways are often needed on gently sloping land but they should be wide enough to do the job and be able to provide pasture or hay. If the proportions are not ample sheet or gully erosion may still take place.

When a farm is planned each piece of land is judged according to its capability to produce, and various use recommendations are made. These may include pasture management, crop rotations to follow, woodlot management and reforestation, farm drainage, fenceline removal or relocation, or any other works and practices which would benefit the farmer and his land.

Planning does NOT need to be so rigid that there is only ONE recommended use or management for a piece of land of one class. Alternative recommendations may be made for a piece of land in a certain class. The first rule is to apply the easiest and cheapest remedy. The next thing that determines the choice of use is the relation of the field to the rest of the farm. Other factors apply, such as suitability for using powered mechanized equipment, or the distance from the barn and ease of access. The final determination depends on the crops and animals the farmer chooses to carry. The final plan, therefore, is the end result of a good many compromises and at each stage of preparing the plan certain choices have to be made.

In this section an actual farm plan prepared by the Soil Advisory Service of the Soils Department of the Ontario Agricultural College is presented. The soils are typical of those found over much of the watershed.

In developing the plan a farm planner goes over the farm field by field and maps the soils as he finds them. He uses an aerial photograph as a base map. The soil series and types are identified and an estimation of the degree of erosion is made by examining vertical sections of the soil. The slope of the land is measured, using a hand level which gives slope as a percentage. A rise of four feet in a run of one hundred feet, for example, is a 4 per cent slope.

The occurrence of watercourses, either permanent or intermittent, with or without a definite channel, is noted, as are fencelines, stonepiles, springs, seepage areas, gullies or any other items of importance.

All of the information gathered is marked on the map, using symbols, and each piece of land of the same type with respect to soil, slope and erosion is delimited by a boundary line.

From the map of soil types and conditions a map of use capability is prepared. Each piece of land is assigned to one of eight capability classes. These classes are the same as those used for the watershed and are included here as part of the plan. On any one farm not all classes will necessarily be found.

The plan of the farm is then worked out with the farmer so that each field, or each piece of land, is put as nearly as is practicable to the use which fits the capability. Any systems of tillage or cropping or special practices to control erosion and water loss are applied where necessary. The fields and rotations are worked out so that there is the correct balance of pasture, fodder and grain to meet the requirements of the herd which the land can carry.

Before the planned rotations are put into effect it may be necessary to arrange a transition period in which the change-over from present cropping to the planned rotation is made without losing a year of cropping. Also, it may take a year or two to get special devices like grassed waterways and terraces in working shape. A time of transition such as this may also prove useful in providing a period during which any desired changes in the plan may be implemented.

In adjusting use to capability it may not be possible to outline fields exactly according to natural soil conditions. The inclusion of a small area of, for example, Class II land in a field which is predominantly Class I land may mean that this small area of land of lower capability will be worked as intensively as the Class I land. This is not strictly following the principle of "using each acre according to its ability", but is a compromise weighed against the possible cost of fence removal, difficulties of tillage and so on. In a plan, therefore, there may be found one or more small areas of one land class within a large area of another land class.

FARM PLAN

OBJECTIVES

The following plan for the use of the land on your farm is designed to:

(a) be a practical working unit.
(b) use the land according to its capability without serious deterioration.
(c) maintain the soil at an economically high level of productivity.
(d) produce an approximately equal acreage of each crop each year.
(e) minimize soil and water losses.

In preparing the plan the following procedure is followed. First, the soil, slope and erosion are mapped on an aerial photograph. Second, the capability for agricultural use is then worked out on the basis of type of soil, stoniness, drainage, steepness of slope and the tendency of the soil to erode. Third, in co-operation with the farmer the farm layout and crop rotations are worked out on the basis of the land-use-capability units (described in the following pages).

Suggested cultural, management and fertility practices are outlined. The location and acreage of any crop in any year is readily found by referring to the cropping schedule.

Discussions on cropland, permanent pastures and woodlots should be supplemented by material found in various bulletins dealing with the different subjects. The material found in such publications is based on years of experience and experimental work and should be adapted to your farm in so far as is practical and applicable.

LANDS WHICH MAY BE CULTIVATED

CLASS I

Class I land is suitable for cultivation without special conservation measures. It must be nearly level, workable, productive, well-drained and not subject to erosion or overflow. This land requires the addition of plant foods that are used by crops or lost by leaching. These plant foods are returned by barnyard manure, green manure crops or commercial fertilizers. Crop rotations to assist in maintaining the productivity are recommended.

MAPPING SYMBOLS USED IN FARM PLANNING

MAPPING SYMBOL (EXAMPLE)

382 sil ← Soil Type
6B2 ← Degree of Erosion
Slope Group
Per cent Slope

Stoniness not a factor of importance on this farm.

SOIL TYPES ON YOUR FARM

382 sil – Huron silt loam
384 sil – Perth silt loam
386 sil – Brookston silt loam
582 1/g – Burford loam

SLOPE GROUPS

UNIFORM SLOPES

A – 0 - 2 *per cent*
B – 2 - 6 " "
C – 6 - 10 " "
D – 10 - 15 " "
E – 15 - 20 *per cent*
F – 20 - 30 " "
G – 30+ " "

IRREGULAR (HUMMOCKY) SLOPES

M – 0 - 7 *per cent*
N – 7 - 15 " "
P – 15 - 25 " "
R – 25+ " "

DEGREE OF EROSION

WIND AND WATER EROSION

0 – No noticeable erosion
1 – Up to 1/2 of the "A" horizon removed by erosion.
2 – Some "B" horizon material in the cultivated layer
3 – Some "C" horizon material in the cultivated layer
4 – Gullies too deep and too frequent for the land to be cultivated
+ – Accumulation of eroded materials

INDIVIDUAL GULLIES

Shallow
Into subsoil
Into parent material

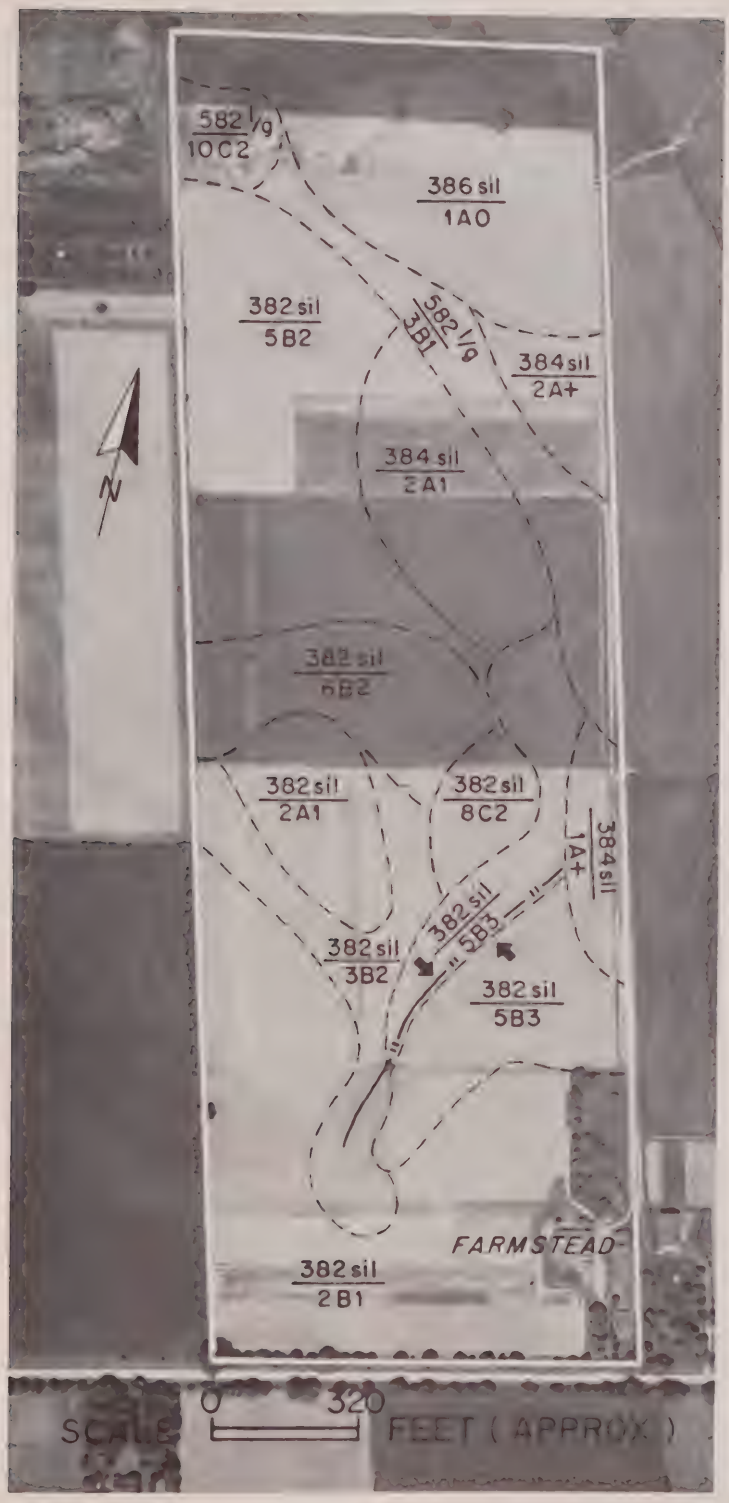
STONINESS

0 – No stone
1 – A few stones but not sufficient to interfere with cultivation.
2 – Sufficient stone to be a nuisance to cultivation but land can be used for regular rotation
3 – Too much stone for cultivation but land suitable for pasture
4 – Too much stone to be used for pasture but suitable for trees

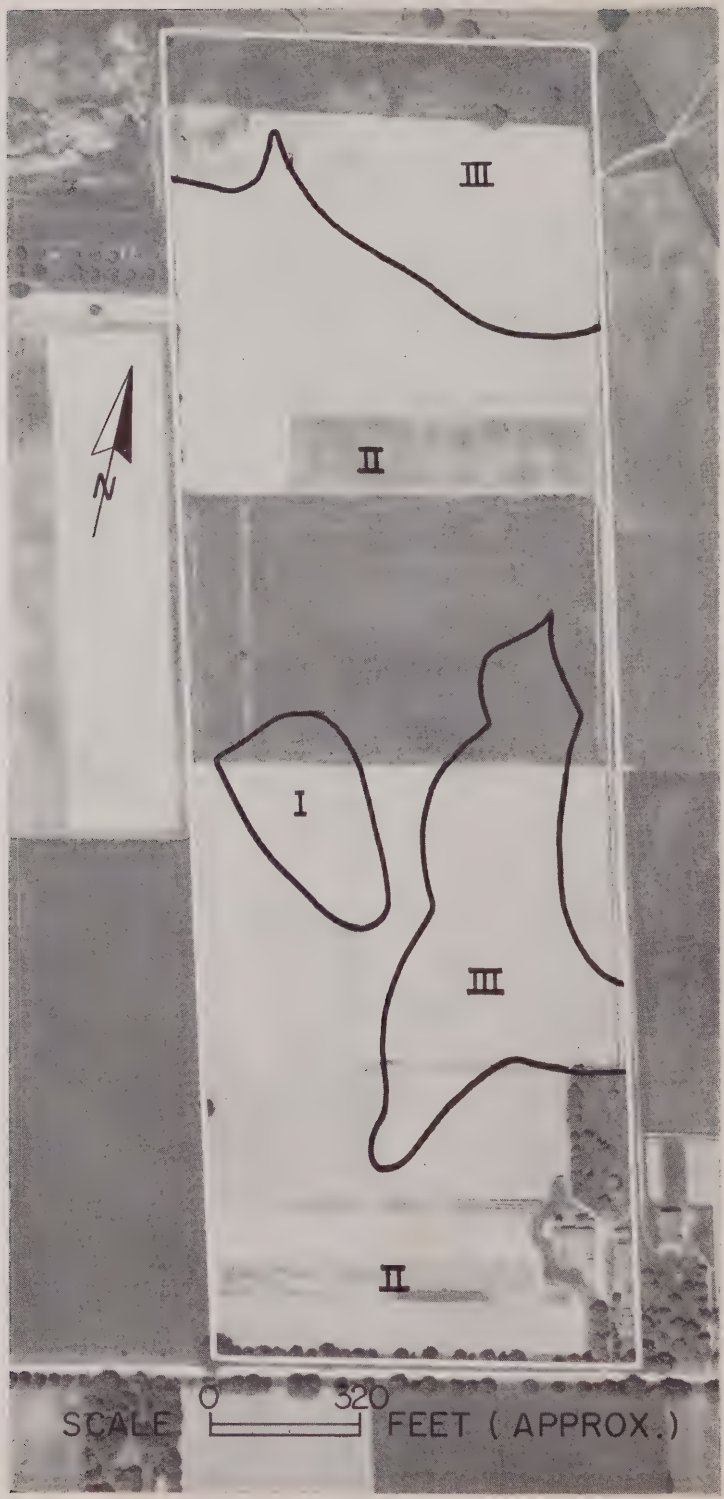
WATERCOURSES

Permanent streams
Intermittent streams
Spring
Sod waterway
Proposed tile

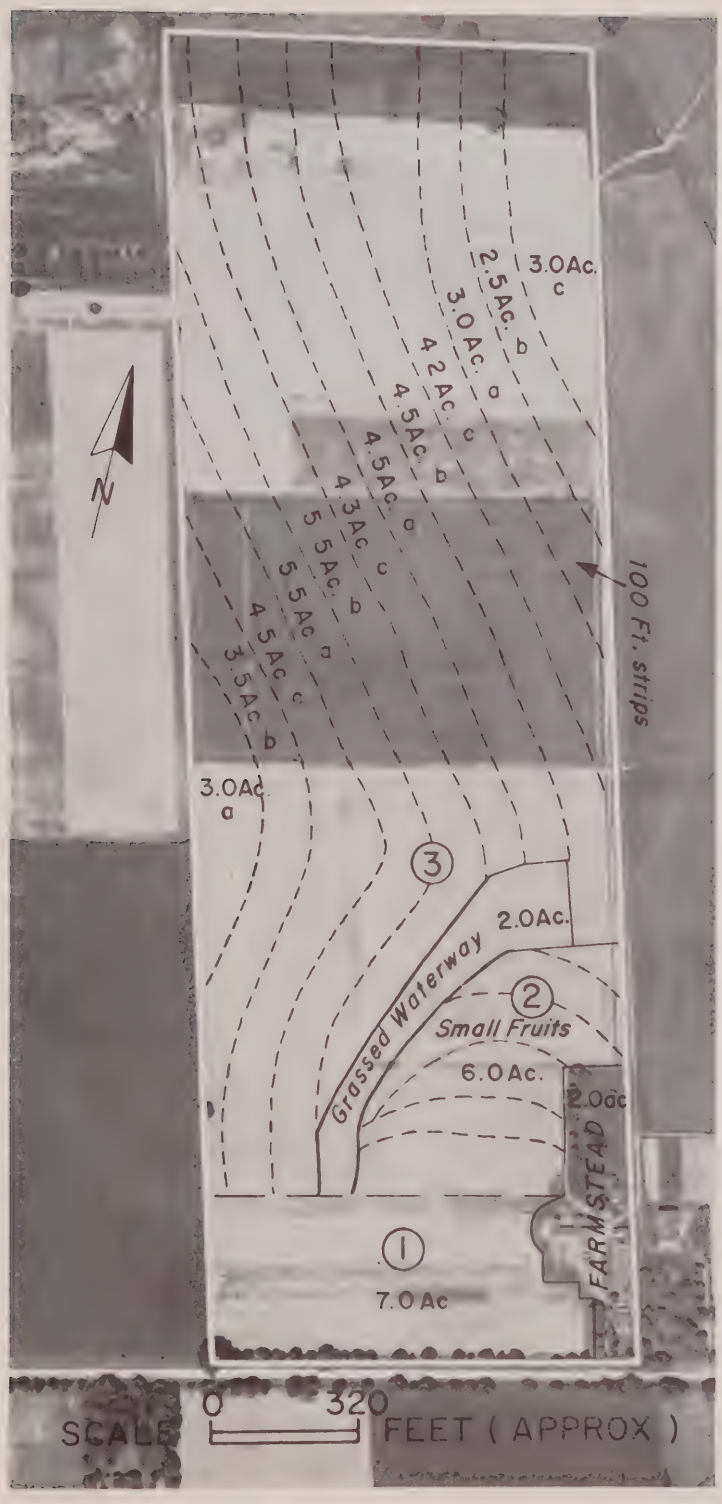
SOILS DEPARTMENT, ONTARIO AGRICULTURAL COLLEGE, GUELPH, ONTARIO


582 l/g
10C2
386 sil
1A0
382 sil
5B2
582 l/g
3B1
384 sil
2A+
384 sil
2A1
N
382 sil
6B2
382 sil
2A1
382 sil
8C2
384 sil
1A+
382 sil
5B3
382 sil
3B2
382 sil
5B3
FARMSTEAD
382 sil
2B1
0
320
SCALE
FEET (APPROX)

LAND USE CAPABILITY



FARM PLAN


N
3.0Ac. c
2.5Ac. b
3.0Ac. a
4.2Ac. c
4.5Ac. b
4.5Ac. a
4.3Ac. c
5.5Ac. b
5.5Ac. a
4.5Ac. c
3.5Ac. b
100 Ft. strips
3.0Ac. a
3
2.0Ac.
Grassed Waterway
2
Small Fruits
6.0Ac.
2.0ac
FARMSTEAD
1
7.0 Ac
0
320
SCALE
FEET (APPROX)


N
0
320
SCALE
FEET (APPROX.)

CLASS II

Class II land is suitable for permanent cultivation with some simple practices often required. Chief types of practices are erosion control, water conservation, correction of moderately low fertility and the removal of boulders. The practices to conserve soil and water include contour cultivation and strip cropping with crop rotations that include legumes and grasses. The various sets or combination of practices must always be practical and useful in maintaining soil productivity.

CLASS III

Class III land is suitable for permanent cultivation with intensive conservation measures. This land requires careful and intensive application of practices to conserve soil and water. The type of practices are similar to those applied on Class II land but their use must be more intensive and widespread. Class III land requires longer rotations of legumes and grasses, cropping in narrower strips, buffer strips, grassed waterways, diversion ditches and greater use of cover crops. Class III land is generally characterized by one or more of the following features: steeper slopes, greater degree of erosion, lower fertility or handicapped by stones, boulders and poor drainage. This land requires additional treatments to maintain the soil at adequate fertility levels for the production of moderate to high yields of good quality crops.

CLASS IV

Class IV land is suitable for occasional or limited cultivation. This land is generally handicapped by one or more of the following: steeper, more severely eroded, more susceptible to erosion, more difficult to drain, less fertile, droughty or restricted in use by stones, boulders, or scrub tree growth. The types of conservation measures applied to this class aim at removing, in so far as possible, the limiting features. To reduce soil losses and conserve rainfall on the steeper slopes, five- to six-year rotations consisting of one year grain and the rest in clovers and grasses are frequently used. Class IV land may be set aside as a pastured area to be broken up and reseeded every fifth or sixth year.

LANDS WHICH SHOULD BE KEPT IN GRASS OR TREES

CLASS V

Class V land is not suitable for cultivation but is suitable for a permanent vegetation that may be used for grazing or woodland. This land is not subject to erosion but is generally too wet or stony for cultivation.

CLASS VI

Class VI land is suitable for permanent vegetation that may be used for restricted grazing or woodlot. Most of the land is moderately eroded or steep droughty soils of low fertility. When used for grazing such restrictions as carrying capacity, deferred grazing and rotation of grazing must be practised.

CLASS VII

Class VII land is not suitable for cultivation and requires severe restrictions if used for grazing. Pastures generally require liberal applications of fertilizers and careful regulation of the grazing. A large part of this land should be reforested or kept in woodlot and fenced from livestock. Most of the land in Class VII is steep, rough, eroded and highly susceptible to erosion.

CLASS VIII

Class VIII land is not suitable for cultivation or the production of permanent vegetation. The land is chiefly rough, extremely stony barren land or swamps and marshes that are permanently wet and cannot be drained.

CROPPING PLAN

		Year		
Field No.	*Acreage*	*1*	*2*	
1	7.0	Flowers, small fruits, etc.		
2	6.0	Flowers, small fruits, etc.		
3(a)	16.0	RC	HC	SG
(b)	16.0	HC	SG	RC
(c)	16.0	SG	RC	HC
Red clover (RC)		16.0	16.0	16.0
Hoe crop (HC)		16.0	16.0	16.0
Spring grain (SG)		16.0	16.0	16.0
Flowers, small fruits, etc.		13.0	13.0	13.0
Cropland		61.0	61.0	61.0
Grassed waterway		2.0		
Homestead, lanes, etc.		2.0		
Total acreage		65.0 acres		

The farm is operated basically as a market garden enterprise, with a limited number of livestock. The farming practices suggested are based on the soil conditions existing on the farm and the enterprises followed.

CROPLAND

This plan is a practical and effective means of conserving soil fertility as well as controlling soil erosion. It presents suggestions for soil management and crop rotations that meet the objectives of good land use.

The preceding map of the farm gives the field layout, number of fields, acreage and plan of operations. This will serve as a key to cropping rotations and practices.

ROTATIONS AND PRACTICES

Fields 1 and 2 are not in a definite rotation and can be used for flowers, small fruits, hoe crops, etc., at your own discretion. These areas are less subject to erosion but require basic fertility applications and organic matter maintenance.

Field 3 is divided into strips (a), (b) and (c). A three-year rotation of hoe crop, spring grain seeded to red clover is suggested. This rotation of crops on the strips will reduce soil and water losses due to run-off.

More cash crop may be substituted in place of the grain crop if mulches, winter cover crops and green manuring crops are used. These will aid in controlling erosion and maintaining a high level of production. Where cash cropping occupies a high percentage of the workable land area, it becomes more necessary to apply the added measures listed above.

FERTILITY MAINTENANCE

The use of complete fertilizers as well as ploughing down the one-year-old sod will help maintain satisfactory fertility and organic matter levels. A fertile soil with sufficient organic matter is much less likely to erode than a soil low in fertility and low in organic matter.

In order to maintain a good fertility balance, soil samples should be taken and sent to the Department of Soils, Ontario Agricultural College, for analysis and fertilizer recommendations.

GRASSED WATERWAYS

Excess water must leave the farm, and in order to facilitate this removal with the least possible damage, a grassed waterway is recommended.

The seeding mixture should contain mainly grasses, as a dense sod is required. Clipping of the waterway should be done at least twice a year.

CONTOUR STRIP-CROPPING

Contour strip-cropping is a practice recommended for the farm to control soil erosion under intensive cropping. Because of the general uniform direction and amount of slope, the contour strips are of even width. These strips are level and follow the topography of the land, hence each plow furrow acts as a small dam.

There should be no difficulty in cultivating and maintaining these strips.

COMMENTS ON THE FARM PLAN

Although the farm described here is not within the watershed and is not primarily a dairy farm there are, nevertheless, various aspects of the plan which are of considerable interest with reference to the watershed. The soils are of the same types as those to be found on Branch Creek and the topography is quite similar. Also, quite a number of farms on the Branch Creek are engaged to some extent in cash cropping.

Neither the watershed nor the farm is plagued by excessive soil erosion, but in both cases there is room for improvement. The measures recommended for this farm will help in no small way to build up the soil organic content and improve the soil structure. They will also be of direct benefit in improving the soil-moisture regime by retaining more of the precipitation on the land.

Under certain conditions it is never possible to retain all of the precipitation; some is bound to flow away as surface run-off. Where this water flows in a channel there is a great risk of gully erosion if the channel is cultivated. This happened on the farm described here and is a common occurrence on the Branch

Creek, although in only a few cases has the situation as yet become serious. Channels such as these should be kept in permanent vegetation after any necessary channel grading is completed. Grassed waterways are often well supplied with water and with fertile silt which becomes trapped in the grass as the speed of water flow is reduced. If made sufficiently large they can be an excellent source of hay.

Little more needs to be said about this plan except that the measures indicated could be applied on almost any farm in the watershed. On some farms, of course, there would be a reduced emphasis on contour work and a greater emphasis on permanent grass and on rotations. Nevertheless, this is a good example of a farm plan.

CHAPTER 7

CARRYING OUT THE LITTLE VALLEY PROGRAM

The more closely use and management of the land fit the recommended pattern, the more nearly the aims of soil and water conservation will be achieved. Adjustments of land use, or the introduction of special methods of tillage and cropping, need not reduce the overall acreage of field crops although this may happen in individual cases. Where changes are indicated in the management of cropland, soil productivity and soil and water conditions generally will be improved.

Some areas of higher capability land are shown which are now in forest cover. It is not necessary at the present time to remove these stands in order to provide more cropland but as the trees mature the land might be cleared and devoted to crop. Likewise, there is land unsuited to the production of good crops or pasture which would be better reforested. By gradually changing the present pattern of land use to the one recommended a better adjustment of use to land will be achieved.

Generally speaking the lands of the watershed have been managed quite well and erosion is not as severe as is often found elsewhere. There are, however, many areas where fruitful work can be done. Gullies are to be found along the main stream and elsewhere and these should be rehabilitated, perhaps with Authority assistance where this proves necessary.

There are, also, many areas where grassed waterways would be beneficial. In most instances they can be built by the farmer himself, often by simply leaving the waterway in grass. In more difficult situations the Authority might be able to provide technical assistance or machinery. The same more or less applies to contour tillage.

Whatever the program, publicity and co-operation with interested agencies are essential to its success. The Authority should endeavour to see that each farmer is fully informed regarding the development of his watershed. Real progress will be made only if each farmer knows what is going on and contributes his support. Given time and effort there is no reason why this Little Valley could not become a model for others to follow and a source of pride to all who live in it. Such improvement would also be beneficial to the farmers in a material way in helping to maintain better land and stream conditions.

3 FOREST

CHAPTER 1

THE FOREST IN THE PAST

1. AT THE TIME OF SETTLEMENT

Good early descriptions of the forests of Southern Ontario are rare, for the early settler regarded the forest more as an obstacle to cultivation than as a positive asset worthy of recording.

Surveys on the northern parts of the Otter Creek Watershed were started in 1797, and all townships in the watershed were surveyed by 1832. From the surveyor's field notes it is clear that they worked through a forest almost untouched by man but broken here and there by a "marsh", a "cranberry bog", a "willow meadow" or a patch of "windfall". Windfalls were frequent, and one surveyor notes in such a patch of down timber "this a Huricane". In Houghton Township, particularly, the windfall areas developed into "thicketts of Briars", which rendered surveying more difficult.

The corner of Burford Township in the watershed contained much ash and cedar swamp, with pine, oak and "chesnut" on the drier patches. The adjoining corner of Windham contained more pine. In Norwich and Dereham many of the swamps were "Tamarac". With much of the soil being heavier, pine was found in small patches with oak and "chesnut" on the sandy ridges or scattered among the other hardwoods. Beech and maple were the most common species, but the hardwood stands contained a rich mixture of basswood, cherry, ash, elm, black walnut, butternut and hickory. Although not noted by other surveyors, Roswell Mount in his 1832 survey of Dereham makes frequent mention of swamp oak and once, just north of Tillsonburg, records "Whitewood" (Tulip). For Middleton, Malahide, Bayham and Houghton, we have more careful records made by Mahlon Burwell and his assistant, John McDonald. Although various hardwoods occurred throughout, pine, oak and "chesnut" were far more common, and the warm climate of the sand plains is evident from the frequent occurrence of "Sasafras and Hazle Bushes" and less often "Dogwood". Sycamore was common in the valleys. White pine fell roughly into three classes: "3 to 4 Ft. Diameter", "2 to 3 Ft. Diameter" and "Small", "Shrubby" or "Scrubby" pine. Mr. Burwell's opinion of the area is expressed in his letter of 1815 to Thos. Ridout, the Surveyor-General:

> "There are beautiful Groves of White Pine Timber, on each side of the Creek, interspersed with Groves of other timber, alternately; there is therefore no doubt, but that ere long considerable quantities of timber will be conveyed down that Stream from Norwich & other places to the Lake."

2. CLEARING THE LAND

The attitude of the early settler to the forest was completely hostile. Although the forest supplied his meagre needs for construction material and fuel, this was but a drop in a seemingly limitless sea of supply. For agriculture to develop the forest must go, and much of it was simply piled and burned. Until about 1910, the decrease in woodland was rapid. After that the small remaining area of woodland was at least tolerated and in some cases has probably shown a slight increase. There is not as yet any evidence of a sharp increase in woodland cover

such as might be brought about by a real enthusiasm for reforestation of submarginal lands.

3. FOREST PRODUCTS

The earliest interest in timber in Ontario was the reservation of pine and oak either by specified areas or by individual marked trees for the use of the British navy. A report of 1797 for the Township of Walsingham lists 124 lots with pine suitable for masting and 22 lots with oak suitable for the Royal Navy. Two of the pine lots and 5 with oak timber are in the section around Glen Meyer which drains into the Little Otter Creek. However, this system was already weakening when settlement in the Otter Creek area began. Otter Creek was remote from the export centre at Quebec; its main period of settlement corresponded with a period of expansion in sawmilling and increasing American markets, and it is unlikely that the Royal Navy did actually draw upon its supplies to the extent that might otherwise have been expected from the abundance and quality of its timber.

That the quality was high is affirmed by A. R. M. Lower, who lists 10 main white pine districts in Canada and says, "The best and largest pine on record came from the peninsula district". In confirmation he quotes from a publication of 1898: "In the region embraced by the counties of Haldimand, Norfolk, Brant and Elgin . . . the quality has never been exceeded by that of any other section of the continent".

The square timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the thirties. Square timber was obtained by selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge" but later, when the best timber had been cut, they were squared with a rounded shoulder or "wane" and were known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for by the British market.

Until 1890 the Census of Canada lists all pine and oak not sawn into lumber as "square timber", and even as late as 1910 most species are listed as "square, waney or flattened".

As already suggested, sawmilling became more important with the growth of settlement and trade on both sides of Lake Erie. Widespread agricultural development in the Otter Creek Watershed was later than in most of the surrounding area, and W. H. Smith's description of Norfolk County in 1851 applied at least in part to Otter Creek conditions:

> "In some localities the preparation of lumber engrosses more of the attention of the settlers than agricultural operations, and is likely to do so till the pine woods are exhausted, which, at the rate the destruction of the forest is now carried on, is likely to be the case in a few years; this, however, is not much to be regretted, as the improvement and cultivation of the land, and consequent enrichment of the district must necessarily follow. During the last season a great number of pine logs have been exported to the American side, sufficient to cut at least three millions feet of lumber; these, of course are sawed in the United States, to the loss of the owners of saw mills on

the Canadian side of the lake; the Americans finding it more profitable to import the raw material than the manufactured article, on account of the diminished duty and other expenses. Canadian sawyers ought to see to this, as, if allowed to go on, it will necessarily increase, and in a very few years their mills will be utterly valueless to them, and the money expended in their construction will be so much dead loss."

He reports that much of Dereham, Bayham, Houghton and Walsingham was largely devoted to lumbering, but his hopes for change are obvious in his description of the road between "Tillsonburg and Sandytown" (now Straffordville):

"This neighbourhood being almost altogether a lumbering country will account for the scarcity of improvements; as, however, the land becomes cleared of its best timber, and lumbering remains no longer profitable, those engaged in the trade will of necessity turn their attention to agriculture, and good farms will supply the place of saw mills."

In the meantime Otter Creek was "the principal mill stream in the county", and Smith records 29 sawmills in Bayham Township alone. Exports from Port Burwell, "the shipping port for the great lumbering country on the Otter Creek and its tributaries", had increased from about 3,000,000 feet of sawed lumber in 1846 to 8,424,154 feet in 1849. "The principal portion of the lumber is shipped to Oswego, Buffalo, Cleveland and Huron." Port Burwell itself had "a steam saw mill, with three saws, capable of cutting one million feet of lumber per annum".

Large quantities also came from the mills upstream and particularly from "Vienna, which is the headquarters of those engaged in the lumber trade of the district". Vienna had three sawmills, but most important was the fact that:

"The Otter Creek is navigable for scows to Vienna, three miles from the port. These scows carry from fifteen thousand to twenty-five thousand feet of lumber which they place on board the schooners at the port; for which they receive about half a dollar per thousand feet."

Although the peak of production for many products was not reached for some time, temporary and local changes are illustrated by the remark that:

"Formerly, large quantities of staves were shipped from Port Burwell, but the oak timber within convenient reach having been used up, the exportation of staves has gradually diminished, till at length it has almost altogether ceased. . . ."

The census of 1851-52 shows a continued advance, with 38 sawmills in Bayham Township reporting a production of 25,570,000 feet. No doubt some of this was reflected in further increased shipments from Port Burwell, but it is to be expected that large quantities also found their way north to Ingersoll and Woodstock.

From 1840 to 1870 a large amount of lumber and squared timber was used for local construction, and particular species were in demand for the manufacture of vehicles, furniture, barrels and woodenware. By the latter date local building had slacked off. The making of vehicles continued until the nineties.

A study of tables of forest products reveals many changes. While the varying basis used for Census of Canada returns at different periods makes comparisons difficult, some general trends are quite clear. The peak production shown for most products is in 1880 or 1890. Soon after 1900 such products as tanbark, lathwood, masts, staves, shingles and piling drop from the list, and production of other products shows a sharp decline. The one product which has persisted throughout the record is fuelwood, which has dropped from a peak of 440,434 cords in 1900 to a low of 37,474 cords in 1950. This decline reflects both the decrease in available supply and the increasing competition of other fuels.

The addition in 1890 of fence posts, poles and railway ties reflects the development of the area. The introduction of wire fencing, the development of the telephone and the expansion of telegraph service all stimulated forest production at this period. The subsequent sharp decline in these products shows the rapid depletion of supplies.

Tamarack was an important timber until 1890 when the species was almost wiped out by the depredations of the larch saw-fly. Walnut, butternut and hickory were important for their special uses, but after 1890 they no longer appear as separate species in the record.

In 1920 no square timber is shown, and from this time on lumber production is small and is no longer separated by species.

Potash shipped to Britain for use in soap making and the dyeing industry was a source of some revenue while land was being cleared. It was extracted from the ashes of hardwood trees, 60 large maple trees producing one barrel of 650 pounds. While family and local village asheries were common in Ontario, only the large commercial plants were recorded. The 1851 census lists one soap factory in Elgin County and one ashery (at Aylmer), a soap factory in Norfolk County and an ashery in Oxford County.

Maple sugar was almost the only sugar available to the pioneers. In 1910 census records begin to list maple syrup as well, indicating the change from a pioneer necessity to a modern luxury. Production in 1951 was less than 10 per cent of that for the peak year of 1861.

CHAPTER 2

SURVEY OF PRESENT WOODLAND

The Otter Creek Watershed lies entirely within the Deciduous Forest Region, the boundary of which passes close to its northern limits. The Deciduous Forest Region enjoys a very moderate climate modified by being bounded by the Great Lakes; Ontario, Erie and Huron. Though the forest in this Region consists primarily of beech and sugar maple together with basswood, red maple, red, white and bur oak, a large number of other species, many of small size, find their northern limit here. Among these are chestnut, tulip tree, pignut hickory; black, pin, chinquapin and chestnut oaks; black gum, blue ash, magnolia, papaw, Kentucky Coffee tree, red bud, red mulberry and sassafras. In addition, within this region is the main distribution in Ontario of black walnut, sycamore, swamp white oak and shagbark hickory, together with the more widely distributed butternut, bitternut hickory, rock elm, silver elm and blue beech. In general coniferous species are poorly represented, but white pine is abundant locally on the lighter soils.

1. SURVEY METHODS

Aerial photographs, each covering about 1,000 acres, were provided to the forestry party, and mapping in the field was done directly on the photographs. Each area of woodland, scrubland, swamp and rough land was visited and described as to acreage, cover type, presence of grazing, reproduction and average diameter at breast height.

Each woodlot was classified as hardwood, coniferous or mixed. The term "hardwood" is used to denote all broad-leaved trees regardless of their physical hardness. A woodlot in which 80 per cent or more of the trees are hardwoods is called a hardwood stand, one in which 80 per cent or more of the trees are conifers is called a coniferous stand, and all others are classed as mixedwood.

Plantations were likewise examined and records made of method of planting, approximate age, care, damage and survival.

Land suitable for reforestation was mapped and descriptions prepared in some detail for the larger areas.

2. FOREST COVER TYPES

The term "forest cover type" refers to those combinations of tree species now occupying the ground, with no implication as to whether these types are temporary or permanent. A slightly modified form of the system drawn up by the Society of American Foresters has been used on this survey so that the system will adequately describe the cover types common to the watershed. The gaps in the numerical system are due to certain cover types common to the eastern United States which do not enter Canada.

The following cover types were encountered on the Otter Watershed:

Type Number	*Name*
4	Aspen
4a	Poplar—oak
5	Pin cherry
8	White pin—red oak—white ash
9	White pine
10	White pine—hemlock
11	Hemlock
12	Sugar maple—beech—yellow birch
13	Sugar maple—basswood
14	Sugar maple
14a	Black cherry
24	White cedar
25	Tamarack
26	Black ash—white elm—red maple
45	Bur oak
47	Black locust
49	White oak—black oak—red oak
49a	White oak—black oak—hickory
50	White oak
51	Red oak—basswood—white ash
57	Beech—sugar maple

Type Number	*Name*
58	Beech
59	Ash—hickory
60	Silver maple—white elm
60a	White elm
61	Cottonwood
88	Willow

So many of these types occur in appreciable amounts that the woodland is extremely varied, and no one type predominates. The most abundant type, beech—sugar maple, makes up 25.7 per cent of the woodland acreage. Flat or mildly rolling terrain in much of the watershed has encouraged clearing of all but the wetter areas. As a result the various swamp hardwood types, now comprising 27.3 per cent of the woodland, appear more prominent than they did in the original forest. Types containing pine or hemlock in appreciable quantities amount to 13.9 per cent and various oak types to another 8.8 per cent of the woodland. Aspen, a temporary type following fire or other disturbance, covers 8.3 per cent of the wooded area.

3. CONDITION OF WOODLANDS

Woodland within the watershed comprises 30,638 acres, which is 15.2 per cent of the total area of 202,222 acres. Of this woodland 78.5 per cent is classed as hardwood stands, 18.5 per cent as mixedwood and only 3.0 per cent as coniferous. There is no doubt that conifers originally formed a larger part of the woodland than they do today, but their numbers were diminished because of the desirability of the lumber they furnished and recurrent fires which have destroyed them while more fire-resistant species such as oak have survived. In addition, much of the best pine land is also well suited to tobacco farming and is now used for that purpose.

Very little of the present woodland is mature and merchantable. Only 1.8 per cent, practically all hardwood, is classed as over 18 inches diameter breast height. Coniferous stands between 10 and 18 inches, a size suitable for poles, make up only 1.5 per cent. The 7.5 per cent of young stands, under 4 inches diameter breast height, and the 56.2 per cent of hardwoods and mixedwood between 4 and 10 inches will require some time to grow to merchantable size. This time may be shortened by thinning the stands where necessary. The remaining hardwoods and mixedwood between 10 and 18 inches diameter (31.5 per cent) and conifers 4 to 10 inches (1.5 per cent) will soon be large enough to provide some merchantable material and should pay for proper management in a relatively short time.

The survey indicates that 80 per cent of the woodland is uneven-aged and therefore might readily become a source of continuous revenue to the owner. However, this continuous production will not last long unless there is an improvement in natural regeneration in the woodlots. Nearly one-quarter of the woodland area shows virtually no regeneration. Less than 9 per cent showed regeneration which could be classed as "good" to "excellent". Fires, considered as unimportant by many woodland owners, are one cause for this condition. The grazing of 21.4 per cent of the woodland is another serious factor. Very few woodlots are protected against cattle, and only the lack of livestock in the tobacco areas prevents more widespread grazing damage.

Slightly over half the woodland has about the desired degree of stocking, and one-tenth is definitely overstocked and needs thinning for improved growth. The rest is understocked or sparse, requiring planting or at least protection to bring it back to a fully stocked condition.

4. SCRUBLANDS

In all 2,530 acres in the watershed are covered with tree species which never attain commercial size. The most common species are scrub willow and dogwood on poorly drained sites and hawthorn and sumach on dry sites. In some cases this land can be improved for agriculture through drainage or through eradication of dry scrub. However, where such restoration does not seem economically feasible, the area should be returned to tree cover through systematic replacement of the scrub species with more valuable species.

CHAPTER 3

MARKETS AND MARKETING

Considerable information about markets for local woodland products has been gathered by the Erie District office of the Department of Lands and Forests at Aylmer. This information, together with observations made during the woodland survey, supplies a general picture of marketing conditions in the Otter Creek Watershed.

For quality products, such as veneer logs, buyers will come one hundred miles or more. For low grade material ten miles may be the limit, and often it is difficult to find a buyer at all. On the other hand, some woods are brought into the area which might be purchased locally if they were grown there in the quantity and quality required.

In many parts of Ontario the truly portable mill, moving to the woodlots it cuts, has disappeared before the impact of better roads and improved truck-hauling to stationary mills. In the Otter Creek area portable mills have persisted. Frequently such mills depend on custom sawing for woodlot owners, the quality of lumber sawed is low and the mills operate only a few days to a few months each year.

As elsewhere, one of the most serious problems is the lack of an adequate market for small or low grade material, which should be removed to improve the growth of quality material in the woodlot. The market for fuelwood for domestic use or tobacco kilns has declined sharply in the face of competition from other fuels, but this use still remains of some importance. A pulpwood market for thinnings from pine plantations is already well established. No such market for hardwood thinnings exists as yet, but recent advances in the pulp and paper industry make it reasonable to expect such a development within the next few years. This type of market does not promise large returns to woodlot owners, but it does promise to defray the cost of woodlot improvements which will allow the progressive owner to produce the quality products from which his real profits are derived.

1. THE TIMBER HARVEST

Harvesting of timber involves four operations: estimation of volume, cutting, skidding and hauling. The owner may perform all operations, selling his logs at

the mill; he may cut and skid the logs, selling them at the roadside; or he may sell his timber on the stump.

(a) *Estimating*

Estimation of timber may be done either in the tree (cruising) or in the log after cutting (scaling).

Some operators cruise timber by rough ocular estimate; that is, by walking through the bush and estimating, on the basis of past experience, the number of board feet in the stand. The most accurate method would be to measure each tree, consider taper and defect, estimate and tally its volume. In large wooded tracts only a representative sample, say 10 per cent or 20 per cent, may be measured and the total estimated from this sample.

One example may illustrate the value of a tallied cruise. Some years ago, in competitive bidding for 87 acres of woodland, one operator estimated a stand, by tallying every merchantable tree, to be 700,000 board feet; the chief log buyer for a large furniture manufacturer estimated 350,000 board feet; another operator estimated 100,000 board feet. The actual cut from the stand was 746,000 board feet. Obviously such discrepancies are of concern to the seller as well as to the bidder who tries to maintain his place in competitive buying. Before selling standing timber, it would pay the owner to make a tallied cruise or, if necessary, to hire professional assistance for this purpose.

Similarly, when selling logs, the owner or his agent should assist in their measurement, try to understand the allowance which must be made for defects and assure himself that he is being fairly treated.

(b) *Cutting and Skidding*

In a typical hardwood operation, the value of logs at the roadside may be half as much again as that of logs in the standing tree. The difference is mainly labour cost.

By performing the operations of cutting and skidding, the farmer increases his return by selling his labour and use of his equipment instead of just his stumpage. The flexibility of woods work in fitting into otherwise slack seasons on the farm should make this increased return particularly attractive. In addition, the farmer doing his own cutting is best able to determine that the right trees are removed and damage to the remaining stand kept as low as possible.

(c) *Hauling*

Truck-hauling has increased the distance from which mills can secure their logs. Cost per thousand board feet hauled depends largely on distance. Thus, while grade 1 logs might be hauled up to 50 miles, the lower value of other logs might limit practical hauling distance to 15 or 20 miles.

While actual figures will vary greatly, the example below will suggest the change in log value at various stages.

Value of logs in the tree (stumpage)	$28	per M board feet
Making logs from tree	8	" " " "
Skidding logs to road	8	" " " "
Hauling logs to mill	6	" " " "
Value of logs in mill yard	$50	" " " "

2. TIMBER SALES

(a) *Outright Sale of Woodlot*

Frequently a sawmiller finds the simplest procedure is to buy the woodlot or farm outright. In this case, the former owner has no further interest in the land. The practice of slashing such woodlots and leaving them to become tax-delinquent was legitimate cause for community concern. Where tree cutting by-laws are rigidly enforced, this abuse should be kept under control.

(b) *Sale of Cutting Rights*

Under this method the owner sells the right to cut all timber of certain species down to a certain diameter; or the trees to be cut may be marked in advance and the sale made on this basis. Often only a very vague word-of-mouth agreement is made and misunderstandings are common. A simple written agreement would avoid this confusion.

A lump-sum method of payment is often used on such sales, based upon a volume estimate by the buyer. As mentioned in the section on cruising, the volume estimates of different bidders may vary considerably. The seller is therefore advised to consult the list of buyers of woodland products in the hands of the Zone Foresters and to obtain competitive bids from as many buyers as possible. On lump-sum purchases the buyer takes all the risk as to accuracy of estimate and quality of timber.

Selling the standing timber at a rate per thousand feet removes the uncertainty of volume estimates and requires measurement of the logs after cutting. Two uncertainties remain—the log rule to be used in measurement and the assignment of logs to different grades which differ in prices per thousand board feet. For Provincial Government transactions the new Ontario Log Rule is now required, but for private sales there is no set standard, the Doyle Rule being most commonly used. The woodlot owner seldom knows the problems of processing logs into lumber sufficiently well to understand fully why the buyer assigns some logs to lower grades. Publication of price lists and grade specifications by log buyers would promote better relations with woodlot owners. Possible arguments and ill feeling over these matters are factors in making some buyers prefer lump-sum purchase. The woodlot owner must decide whether to accept volume and grade risks in the hope of getting a better price by selling on a log measurement basis.

In the event that he chooses to be paid on a volume-removed basis, just what the buyer intends to cut and pay for should be absolutely clear. Only the best trees might be removed, and it is possible that only the best logs from these trees might be taken. This leaves the owner with many poor quality logs which he cannot readily sell and with some poor trees standing which he wanted cut. The volume actually paid for might be small, and the woodlot owner's total realization on the transaction might be less than he would have received had he accepted payment in a lump sum.

No matter which of these two methods is chosen, a written Timber Sale Contract should cover the transaction. It should set forth all the details necessary as to prices, species, sizes, rights granted to the buyers, limiting dates, times of payment and so on.

(c) *Owner-Made Logs*

The woodlot owner who has decided to realize not only the value of his woodland product but also the additional labour income derived from its harvest prefers to take payment at a price per thousand board feet for logs placed on skids at the roadway or logs delivered to the mill. Here again the securing of competitive bids and a clear understanding with the buyer regarding log grade will avoid any feeling of unfairness in the deal. An owner who simply arrives at the mill with a load of logs may feel that he has to accept the offered price even though he is dissatisfied.

CHAPTER 4

FOREST CONSERVATION MEASURES IN PROGRESS

1. PRIVATE PLANTING

The soil of a considerable portion of the Otter Creek Watershed is of a light, sandy nature, ideally suited to reforestation purposes. Similar conditions extending to the east led to the establishment of the Provincial Forest Station at St. Williams in 1908. As a result the value of windbreaks and forest plantations was gradually realized. With the development of tobacco growing much of the light soil was no longer available for trees and in some cases former plantations have been cleared. However, private tree planting has continued on lands unsuited to tobacco and a total of 1,584 acres is now established on the watershed. The portion of this area established by various dates is shown below.

Present Plantations Established by	Area (Acres)
1915	2
1925	21
1935	368
1945	969
1955	1,584

Private individuals and municipalities may obtain advice and assistance in reforestation and woodlot management through the Department of Lands and Forests' Zone Foresters at Aylmer for Elgin and Norfolk Counties, at Stratford for Oxford County and at Hespeler for Brant County. The Zone Forester also assists in the establishment of Authority forests, county forests, demonstration and school plots.

Survival and growth of seedlings have been good, but recent insect damage has caused some concern. About one-third of the older plantations have been thinned and a similar area pruned. The remainder would benefit from similar treatment. In a few cases cattle have been allowed to damage the plantation, and in several others fire has caused some damage.

About half of the recent plantings are devoted entirely to Christmas trees. Only a small minority of these growers are pruning or otherwise caring for their plantations to produce top quality trees.

2. AUTHORITY FORESTS

Fifteen Conservation Authorities have now entered into agreements with the Ontario Government for the establishment and management of Authority forests. The Province advances half the cost of the land and, in some cases, where it is necessary or desirable to include merchantable timber, the Province also assumes the cost of the merchantable timber. These agreements run for a period up to 50 years, during which time the Ontario Government agrees to establish the forest and pay the cost of such items as fencing, buildings, equipment, labour, maintenance, trees, etc.—in short, everything connected with the management of the forest.

A primary consideration in choosing areas for Authority forests is the protection of the headwaters of streams. The Otter Creek Conservation Authority had, by the time of the survey, already decided to implement such a program. Options were, therefore, taken on areas which constitute the nucleus of the Otter Creek Conservation Authority Forest. By 1962 the Otter Authority forest had increased to 1,042 acres.

3. COUNTY FORESTS

Many counties have established forests under agreements which differ only slightly from those described for the Conservation Authorities.

The only county plantation within the watershed is the Zenda Tract of the Oxford County Forest.

The Zenda Tract, which contains 105 acres, was acquired by the County in three parcels, from 1939 to 1955. Nearly half of the tract is natural woodland and much of the open area has been planted, but restoration of forest conditions on some of the more difficult scrub covered sections remains to be completed.

4. DEMONSTRATION WOODLOTS

The most important measure which could be taken for forest conservation would be the improved management of present woodlots. An early effort in this direction was the establishment by the Department of Lands and Forests of demonstration woodlots. These are areas of private woodland on which the owners have agreed to follow prescribed methods of woodlot management and to permit access to the area by interested persons.

Eight demonstration woodlots were established in the Otter Creek Watershed.

Well-conducted demonstrations could exert an influence for proper management in the surrounding area. Unfortunately, some of these demonstration woodlots have been cut over when the property changed hands, and others have been neglected so that they no longer serve their original purpose.

5. TREE FARMS

In the past few years a movement has been under way to recognize well-managed forest properties as Certified Tree Farms. With the sponsorship of several organizations interested in better forestry, the Canadian Forestry Association in 1953 formed a National Tree Farm Committee to recognize with a suitable sign and certificate those owners who agree to maintain their land for growing forest

Pruning of Christmas trees produces good form and attracts the buyer who puts a premium on quality.

This fine young pine plantation shows clearly how neglected corners of the farm may be returned to profitable timber production.

crops, protect the land adequately, agree that cutting practices will be satisfactory to ensure future forest crops, and permit inspection by Committee foresters. Two Tree Farms have already been certified in the Otter Creek Watershed.

Several Conservation Authorities have become co-sponsors of the Tree Farm movement in their areas, and it is recommended that the Otter Creek Conservation Authority give its support to this movement.

6. TREE-CUTTING BY-LAWS

Under The Trees Conservation Act of 1946 and its successor The Trees Act (R.S.O. 1950, c. 399) twenty-one counties have passed by-laws to restrict and regulate the cutting of trees. These by-laws do not interfere with the right of the owner to cut material for his own domestic use, but specify certain diameters below which trees may not be cut for sale.

The four counties covering the Otter Watershed have limits ranging from twelve inches to twenty inches for the major timber species and from five to ten inches for minor species such as cedar.

Better than a rigid diameter limit is the marking of trees for cutting according to their condition. Professional advice on such marking is available through the Zone Forester. Many tree-cutting by-laws provide for the necessary variations from a strict diameter limit where the cutting is done under such supervision and in accordance with good forestry practice.

7. 4-H CLUBS

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests and must be sponsored by an organization interested in the improvement of woodland and reforestation.

At present none of these clubs are operating on the Otter Creek Watershed. Sponsorship of such clubs would be a worthwhile project for the Authority.

CHAPTER 5

SOME FOREST CONSERVATION MEASURES REQUIRED

1. WOODLOT IMPROVEMENT PROJECTS

For most persons the best lesson in conservation is field observation of specific examples of the present abuses and efforts to remedy them. Woodlots chosen as illustrations must be near good roads and should be marked with large signs giving considerable detail of conditions and improvement measures in progress. Roadside or other parking facilities would have to be provided so that visitors could take the full time necessary for inspection without interfering with other traffic.

The reports lists 8 examples of well-located woodlots suitable for Authority woodlot improvement projects. The Conservation Authority should decide on suitable forms of agreements, leases, etc., explain the purpose of these projects to the owners and try to enlist them as co-operaters. The list is by no means exhaustive, but serves to illustrate the type of woodlot suitable for such projects.

2. PRIVATE REFORESTATION

On many farms, even in good farming areas, there are small tracts which, because of steep slopes, poor drainage or severe erosion danger, would be better in tree cover. These tracts are not suitable for public acquisition and management.

but the effect of reforestation on control of run-off, improved summer stream flow and stabilization of wood-using industry justifies public assistance in such work. These areas have not been privately reforested heretofore because the owner has some other minor use for the area, because he is discouraged by the long period between planting and harvest of a forest crop or more commonly simply because of inertia on his part. The interest of private owners in reforestation may be fostered in several ways. Public education, such as that now carried out by the Zone Forester in the district, can be furthered by the Authority. In addition, direct assistance to private planting can be given. Several other Conservation Authorities have purchased tree-planters which supply a planting service to private owners at a nominal cost. Where rough ground makes hand planting necessary, some Authorities pay a direct cash subsidy if inspection shows that planting has been done carefully and the plantation is adequately protected from livestock.

It is the policy of the Department of Lands and Forests to charge $14 per thousand for Scotch pine and $10 per thousand for other planting stock. For some years trees were distributed free. Following the end of the war in 1945, the nurseries were unable to meet the greatly increased demand, and it was felt that a charge for trees would ensure more care in ordering the required amount and in planting the trees received. The assistance schemes carried out by other Authorities have stimulated interest in private reforestation while still ensuring the good use of the planting stock. It was recommended in the survey report that the Otter Creek Conservation Authority adopt some similar policy of assistance to private reforestation, and an active program is now in operation.

3. OTTER AUTHORITY FOREST

When large areas (100 acres or more) require reforestation or woodland management, the task is frequently too great for private initiative. In such cases acquisition by the Authority is recommended. This is particularly desirable where these forests form natural water-storage areas which decrease the severity of floods and maintain the summer flow of streams.

In all, 4,909 acres are recommended for acquisition by the Otter Creek Conservation Authority. Of this total, 535 acres are open lands, 4,108 acres have some form of tree cover and 265 acres are scrub.

4. FOREST RESEARCH

Detailed scientific research is the task of universities or government departments with greater research facilities than are available to a Conservation Authority. Large-scale application of proven methods is the task of private owners or of the Department of Lands and Forests in managing Authority forests. Between these two extremes, however, there are many possibilities for small-scale investigations which are urgently needed and which the Authority might encourage on its own land or on private land under agreement.

5. THE AUTHORITY AND CONSERVATION EDUCATION

Many agencies at present do, or can, engage in conservation education. The Authority can supply opportunities and materials to encourage and enlarge these activities. Wall maps, literature, conservation pictures and conservation lectures supplied to the schools will help to give geography, history and conservation practices a local significance. Building up a library of slides on local conservation problems and accomplishments would be of great assistance to speakers.

Removal of poor trees for fuelwood has improved the woodlot on this Tree Farm. The marked trees are being used to study growth rates in this stand.

Indiscriminate slashing has destroyed the timber-producing capacity and greatly reduced the effectiveness of this swamp for water storage.

The most effective educational activity is actual participation in or field observation of conservation projects. Tree planting days, group visits to woodlot improvement projects and conducted tours over a well organized conservation trail could all be sponsored by the Conservation Authority. These activities would all stimulate individual action in forest conservation measures, such as those described in the following chapter, which cannot be carried out directly by the Authority.

CHAPTER 6

FURTHER CONSERVATION MEASURES REQUIRED

1. WOODLAND MANAGEMENT

The woodlot inventory shows that there are 30,638 acres of woodland on the Otter Creek Watershed. Practically all of this area requires better management. While experimentation is desirable to determine the best method of handling certain problems, the general principles of woodlot management have been known for years but have not been applied. A free advisory service is available from the Zone Foresters, but is not sufficiently used, and a readily understood pamphlet on "The Farm Woodlot" can be obtained from the Department of Lands and Forests.

One of the most difficult problems confronting the private owner in the management of his woodland is the utilization of the small woodland products which can be readily made and handled by the owner. These products such as fuelwood, pulpwood, bolts, posts and poles, if properly harvested, increase the productivity of the woodlot and the gross returns per acre. The volume of these small products has been reduced by diameter limit regulations which have restricted the wholesale commercial slashing of woodlots. Nevertheless, much material of this type could still be produced from thinnings and improvement cuttings and from limbs and tops of trees. The difficulty of marketing such low-grade material has seriously hampered owners in carrying out the needed improvement work in their woodlots. Any means which can be discovered for using small and poor-grade wood should be developed to the fullest extent. At the present time interest is increasing in the possibility of manufacturing wood chips in the woodlot by means of a portable chipper. Such chips can be used for the manufacture of pulp for paper, and as cattle bedding and chicken litter, which can subsequently be spread on fields to increase the humus content of the soil. They can be made from any species of wood, and tops and branches can be utilized. The number of pulp companies which can use hardwoods is limited at the present time and only those making kraft paper can use chips containing bark, but the demand for hardwood chips will increase and portable barkers are being developed. Every woodlot owner should consider the possibility of improving the quality of his woodlot by utilizing the low-grade material as chips or otherwise.

Owners of large woodlots might be encouraged to undertake thinnings and improvement cuttings if equipment or trained crews were available at reasonable cost. The Authority should consider offering such a service. As an alternative, the Authority might offer a subsidy for each acre improved to its specifications and found satisfactory on inspection by the Authority's officers.

2. ELIMINATION OF WOODLAND GRAZING

This abuse is less widespread on the Otter than in some sections of Ontario simply because many farms devoted to tobacco growing do not carry any livestock. Where cattle are kept, grazing of woodlots is common. There are a number of reasons for the widespread practice of allowing woodland grazing. The woodlot has always been considered a pasture field even though the value of woodland pasture is low compared to cleared land. The reason for its low carrying capacity is partly because grass grown in the shade is not nearly as high in food value as that grown in full sunlight. The following statement in respect to woodland pasture has been made by leaders in agriculture: "On the whole, the opinion of the Agronomists is that, on the average, woodland pasture will produce about one-sixth the quantity of pasturage, and the quality will be about one-half as good as that of the improved pasture". Weeds are usually prolific in wooded pastures, often smothering most of the grass.

If shade is required for stock, it may be desirable to leave a portion of the woodlot in the pasture when fencing the woodlot. Another solution is to establish small groves of fast-growing hardwoods which can be fenced temporarily until the trees are sufficiently tall that browsing will not damage crown growth. Where springs or streams that supply water for the stock are situated in the woodlot, access may be made to a trough near the spring and the area should be fenced to prevent trampling.

A fully timbered maple stand, 60 years old, may yield about 4,000 board feet of saw timber per acre. Such a woodlot is virtually ruined by 20 years of heavy grazing, whereas 20 years of protection and no logging may increase the net volume to approximately 8,500 board feet per acre. The gain of 4,500 board feet is equivalent to an annual increase of 225 board feet per acre. At $28 per thousand on the stump this amounts to a mean annual gross income of $6.30 per acre over the period of utilizing only the increase in volume.

Livestock admitted to woodland browse on the leaves and shoots of small trees and ride them down, and by scuffing the surface roots of larger trees injure them and permit entry of fungus diseases.

Field observations indicate that cattle have preference habits in grazing woodlands. Unfortunately this preference is for the more economically desirable species such as maple, basswood, elm and beech, whereas undesirable species such as hornbeam, blue beech, dogwood and hawthorn are grazed only when cattle are seriously underfed. This combination of factors, under continued grazing, changes not only the quantity but the quality of the reproduction and so the succeeding stand. The poorer hardwood species, and conifers where these occur, are favoured. The invasion of pastures by cedar and hawthorn is an illustration of this grazing preference.

Livestock grazing affects more than the growth of trees on the owner's land. Soil erosion in the woodland increases as the absorptive capacity and mechanical protection afforded the soil by the litter is reduced. The open canopy exposes the soil to the erosive force of rain impact and a compacted soil forces overland movement of water. Livestock tend to follow trails in the woodland and these often become centres of serious erosion. Thus continued grazing increases surface run-off and soil erosion.

Erosion on bare slopes threatens the adjoining land. Tree cover could stop erosion and restore the area to productivity.

Windbreaks protect the crop and add beauty to the farm.

It is recommended that the Otter Creek Conservation Authority through discussions with woodlot owners should formulate a program of fencing woodlots which will stimulate action toward the elimination of woodland grazing and the improvement of private woodlands.

3. FOREST FIRE PROTECTION

In spite of the publicity given to the damage caused by fire the average person does not realize how serious this is. Though he may know that young growth and small trees are burned by surface fires he does not realize the extent of the less obvious damage such as the destruction of humus which itself preserves the condition and water-retaining capacity of the soil. When the humus and ground cover are destroyed the sun and dry winds remove the moisture required for tree growth and plant nutrients are destroyed. The heat of the fire also injures the growing tissue inside the bark of older trees which are not actually burned, exposing the wood to attack by insects and fungi. Even though through time the wounds may be completely healed, the damage shows up as defects when the tree is cut for lumber.

It is therefore recommended that the Authority set up a committee to determine the best method of providing fire protection for public and private lands, through the co-operation of the Department of Lands and Forests, for the protection of woodlands in the Otter Creek Watershed.

4. PROTECTION FROM INSECTS AND DISEASES

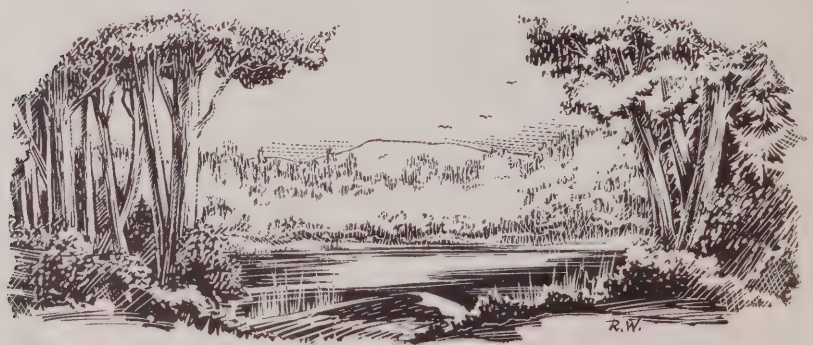
In projects such as the public and private reforestation recommended for the Otter Creek Watershed, careful consideration should be given to the prevention of outbreaks of insects or tree diseases and adequate arrangements made for the immediate application of control measures when these become necessary.

It is essential that an inspection be made each year so that any abnormal increase in insects or disease may be noted and control measures initiated before the outbreak becomes serious. Prompt action may reduce control measures to a comparatively easy task and confine damage to a small area.

5. WINDBREAKS AND SHELTERBELTS

In the process of clearing land for agriculture, woodlots and belts of trees along fence lines have been removed which had served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario.

Experience has shown that windbreaks are an asset to any farm, that their adverse effects, if any, are local and easily remedied, and that in many areas they are essential to the control of soil erosion by wind. It is therefore recommended that the Authority encourage the establishment of windbreaks by private owners in every way.



4 WATER

CHAPTER 1

GENERAL DESCRIPTION OF THE WATERSHEDS

1. BOUNDARIES AND DIMENSIONS

The Otter Creek Conservation Authority is composed of the drainage area of Otter Creek and its tributaries and the adjoining drainage area of Little Otter Creek. The drainage area of Otter Creek and its tributaries is 272.80 square miles and of Little Otter 43.17 square miles, or a total of 315.97 square miles for the Authority.

2. MUNICIPALITIES

The municipalities within the Otter Creek and Little Otter Creek Watersheds are: parts of Burford, Oxford East, Norwich North, Norwich South, Dereham, Windham, Middleton, Walsingham, Houghton, Malahide, Bayham and Dorchester South townships; the town of Tillsonburg and the villages of Norwich, Vienna and Port Burwell.

3. TERRAIN

Except for the river valleys the topography of the area varies, in general, from fairly level with good drainage to undulating. The streams are youthful in appearance, having deep V-shaped valleys with little or no flood plain. Below Tillsonburg the valleys vary up to 100 feet or more in depth and approximately one half mile in width.

4. RIVERS AND MAIN TRIBUTARIES

The Otter Creek rises about 3 miles west of the village of Burgessville. Its course in general is south-east through and 4 miles beyond the village of Norwich, where it swings south-west through the town of Tillsonburg and continues in that general direction to its confluence with the East Branch, thence in a general south-east direction through the village of Vienna to Port Burwell where it empties into Lake Erie. The creek has a total length of about 54 miles and a fall of about 440 feet. The stream gradients vary from 3.7 feet per mile in the lower reaches to as high as 67.5 feet per mile in the headwaters, with an overall average gradient of 8.2 feet per mile.

The principal tributaries of the Otter Creek and their points of confluence relative to Tillsonburg are: Stony Creek at Tillsonburg, the East Branch 17 miles downstream and Spitler Creek about 8 miles upstream.

The Little Otter Creek drainage system has several headwater streams of equal size and importance which rise in the height of land between the drainage areas of the Otter Creek on the west or north-west and the Big Creek on the north-east and east sides.

The main branch rises north-east of Glen Meyer at an elevation of 755 feet and flows in a general south-west direction to its outlet into Lake Erie about ½ mile east of Port Burwell. The overall drop from the headwaters to Lake Erie is 183 feet for an average gradient of 16.5 feet per mile. Gradients of the other main headwater tributaries average about 30 feet per mile.

Hemlock Creek is a tributary in the lower part of the area joining the main stream 1.5 miles upstream from the mouth.

Highway No. 3 west of Tillsonburg. 1949 spring flood shows Otter Creek 2 feet deep over highway and at least 10 feet above normal.

(COURTESY TORONTO DAILY STAR)

Borden Plant at Tillsonburg isolated by flood waters. February 1954.

(COURTESY MR. SELDON, TILLSONBURG)

Highway No. 3 west of Tillsonburg, February, 1954. Flood waters on this occasion reached a depth of 5 feet over the highway.

CHAPTER 2

FORMER FLOODS

From entries in the notebooks of surveyors and other sources we know of a number of freshets on the streams in this region between 1790 and 1810, some of them severe floods. At this time the Otter Creek area was unsettled and crossed by no important trail. Only one of these references is to a freshet on that river, although Big Creek had flooded in spring in 1796 and 1797, and in autumn in 1797, under conditions that must have produced freshets on the neighbouring streams.

The first direct reference to Otter Creek occurs in the Diary of a survey of Houghton, Bayham, Malahide and Yarmouth Townships, carried out by Mahlon Burwell in May and June, 1809:

> "Wednesday, 31st May—Hindered some time crossing Big Otter Creek, had to fall a large Hemlock Tree across it which would have failed us had not the Creek been narrower below that the banks interfered as it swam down."

It is worth noting that this was an early-summer flood, caused by rain only.

A freshet is mentioned in a late account of George Tillson's arrival at the site of Tillsonburg in 1825. After 1830 references to flooding in this part of Western Ontario are more frequent. Floods are known to have occurred over most of the area in 1832, 1833, 1836, 1837 and 1838. A traveller on the Talbot Road in March 1833 found Otter Creek ten feet deep and twenty yards wide and was told that this was about twice the normal depth in summer. The bridge seems to have been undamaged, but this was apparently not the peak of the freshet. In 1836 a thaw towards the end of February put parts of the road from Vienna to Middleton and Burford under water. The real break-up at the end of March was prolonged into April by heavy rains.

Toronto papers have few reports from the area until after 1860. There must have been sizeable freshets on Otter Creek in some of the years that produced several floods over the whole province—for example in 1843, 1851 and 1857. In 1865 the Tillsonburg Observer reported a flood on March 23. Between 1861 and 1956 fourteen floods of varying severity are recorded.

The material collected would appear to indicate that, though the spring freshet on Otter Creek often produces heavy flooding, a really severe flood in winter or early spring is rather exceptional. On the other hand, it is evident that unusually heavy or prolonged rains may, under certain conditions, produce a flood at any time of year, without any assistance from melting snow or ice. Some of these floods have been the most severe on record. The great flood of April 1937 was of this character, although it occurred during the spring months. In this flood the depth of water over Highway No. 3 at Tillsonburg was by far the highest on record. The statement that at Vienna the water was slightly higher than at any time since before 1867, rests on private records which have not been traced, but which appear to be reliable. Without this, it might appear that the water had been as high or higher in 1868.

Human memory seems to be short where floods are concerned. The frequent statement that a flood is "the highest ever" cannot be accepted without some kind of checking. On the available records it can be concluded that Otter Creek has produced at least one really severe flood in most periods of ten years, and that these are as likely to be produced by prolonged rain or sudden storms as by the spring break-up. Not all the cyclonic storms that have caused damage in Ontario are recorded to have brought floods in this area. In several cases a very slight change of direction would have brought the centre of the storm over Otter Creek. Flash floods of this kind are not likely to grow fewer. They have caused catastrophe in Ontario in recent years. These sudden storms, occurring with little warning at any season, are the most striking flood threat at the present time, but the damage caused by the spring thaws cannot be ignored. Neither type of flood can be prevented, but reasonable measures of control can greatly reduce the risk and damage that inevitably accompanies them.

CHAPTER 3

HYDROLOGY

HYDROLOGY encompasses the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground. The movement of water from the atmosphere to the ground and back again to the atmosphere is called the "hydrologic cycle". There are many factors which influence the water movement, and particularly that portion between the incidence of precipitation over land areas and the subsequent discharge through stream channels or direct return to the atmosphere by evaporation and transpiration.

The drainage area of Otter Creek is subject to the constant phases of the hydrologic cycle and like other areas, problems exist which are peculiar to the prevailing climatic conditions and the physical characteristics of the area.

1. PRECIPITATION, STREAM FLOW AND RUN-OFF

(a) *Precipitation*

The word "precipitation" as used in Meteorology includes all moisture that reaches the earth, whatever its form—rain, snow, sleet, hail, dew or frost. The most significant of these are rain and snow. Through the Lake Erie-Niagara Peninsula region, the average annual precipitation is 33.7 inches, determined from meteorological stations with records of observation ranging from 21 to 45 years.

The Otter Creek area is in approximately the centre of this region and from stations within and in close proximity to the area, with periods of observations ranging from 18 to 20 years, the annual precipitation varied from a low of 26.6 inches in 1941 to a high of 45.1 inches in 1945 with an annual average precipitation of 34.3 inches for the period of records.

(b) *Stream flow,* or run-off, consists of surface flow and ground water which is constantly entering the stream channel along its course and is broadly the excess of precipitation over evapotranspiration and deep seepage. Surface flow is that portion of rainfall, melted snow and/or ice which reaches the stream channels directly by flowing over the ground surface.

Ground water flow (percolation) is going on continuously and is responsible for maintaining the flow in streams during periods of drought. This portion is usually classified as base flow.

Measurements of stream flow on Otter Creek have been taken daily since 1948. The gauging station is located near Vienna and has a drainage area of 263.0 square miles.

2. MAXIMUM FLOWS

(a) *Spring Freshets*

Where structures such as dams are concerned, it is not the ordinary or average flows that are significant, but the unusual or exceptional ones that may have occurred in the past, or may reasonably be expected to occur in the future.

By examination of the available hydrometric records of the gauge at Vienna, it is obvious that the maximum flows have occurred most frequently during the late winter and early spring months. The maximum mean daily recorded flow is 4,230 c.f.s., which occurred in February 1954.

(b) *Other Than Spring Freshets*

In recent years it has become apparent that flood run-off resulting from rainstorms without the aid of melting snow and ice is more significant, and in many instances of a magnitude in excess of that experienced in the spring freshet period.

3. UNIT HYDROGRAPHS

Where reasonably accurate rainfall and stream flow records are available, the use of the unitgraph method is most adaptable to the problem of design storm flow. The stream flow records for Otter Creek are of short duration and observations are made just once a day, except for two occasions in April 1950 when observations were made at shorter intervals of one and two hours.

There are no rainfall observation stations within the Otter Creek Watershed, the nearest being at Delhi in the adjacent Big Creek area. However, from the records available an attempt has been made to arrive at a suitable unitgraph that would be representative of the area. To determine the rainfall duration period of storms it was necessary to depend on records of the self-recording gauges at London and St. Thomas.

4. DESIGN STORMS

The "design flood" flow is generally referred to as the hydrograph or peak discharge that is finally adopted as the basis for the design of any particular structure. This flow is dependent on a consideration of the flood characteristics of the particular area and on economic and other pertinent practical considerations.

The flood damage in the Otter Creek region has not been serious and the extent and occurrences have been outlined in Chapter 2. The actual records show that excessive stream flow usually occurs during the late winter and early spring seasons. However, it is known that a storm such as occurred over Southern Ontario in October 1954, if concentrated over the Otter Creek area could produce a flow far in excess of anything previously recorded for this area.

5. LOW FLOWS

From the available hydrometric records for the gauge at Vienna it can be seen that the periods of low flow occur in July, August and September, and occasionally in October and November.

The minimum flows recorded over the period from 1948 to 1956 occurred in July 1954, when 30 c.f.s. was recorded on the 30th and 31st.

Over the period of record the averages of the minimum monthly flows are lower for August, September and October, with August the lowest, averaging 56 c.f.s. This is equivalent to 0.244 inches depth on area. The minimum daily recorded flow of 30 c.f.s. is equivalent to 0.131 inches depth on area.

These quantities, of course, are applicable only to the point of the gauge at Vienna, and it is certain that the contribution is not uniform from the various tributary areas and that many of the smaller streams would be dry during such periods of low flow.

At first glance the above quantities of water seem to be adequate for normal use in an area such as Otter Creek. However, this depends a great deal on distribution, the present water requirements and particularly the future demands of the area in question.

6. WATER USES

(a) *Domestic*

As far as can be ascertained all of the area's water supply is taken from wells. There are only a few communities of any size in the area, viz.: Tillsonburg, Norwich, Otterville, Vienna and Port Burwell.

Of these Tillsonburg and Norwich operate a water supply distribution system to serve local residential, commercial and industrial users to the extent of approximately 508,880 and 300,000 Imperial gals. per day, respectively.

Tillsonburg also operates a sewage disposal system which empties into Otter Creek.

(b) *Commercial and Industrial*

At the present time the demand for water in commercial and industrial plants is relatively negligible. The bulk of the demand is concerned with processing agricultural products such as fruit and vegetables and dairy products.

All of this water, both domestic and commercial-industrial, will eventually find its way back to the river, but there is a temporary withdrawal from ground water sources which would, in the case of shallow wells, have an effect on the ground water table in the immediate vicinity of withdrawal.

However, as mentioned above the present combined domestic, commercial and industrial water demands of the area appear relatively small.

(c) *Agricultural*

The use of water for agricultural purposes is, without doubt, of much greater proportions than for any other single purpose in this area. It is quite probable that agricultural use of water may exceed the combined demand for other purposes. This, of course, is significant only in the growing season, when agricultural use of water for irrigation purposes may be necessary.

The present uses of water, namely: domestic, commercial and industrial, and agricultural, all tend to contribute to a temporary withdrawal from the ground water sources which, particularly in the growing season from June to September, would have an adverse effect on the river flow.

Although the uses of water for other than agricultural purposes appear to be negligible at the present time, it should be kept in mind that with the rapid industrial expansion and the potential effect of the St. Lawrence Seaway, this area will, no doubt, produce infinitely greater demands than the present available water resources could support adequately. The use of water for agricultural purposes, particularly irrigation of tobacco crops, is increasing and will continue to increase for many years to come.

CHAPTER 4

WATER PROBLEMS

The water problems in this area such as flooding, low flows and pollution are not as serious as on many other watersheds in Southern Ontario. While in most watersheds the flood problem is paramount, in this area the chief problem is the maintenance of adequate summer flow and ground-water storage to meet the expanding irrigation needs and satisfy other water requirements.

1. IRRIGATION

From the flow records it is evident that there is not sufficient water during the summer months to permit direct pumping from the streams for irrigation demands and at the same time satisfy the needs of the riparian owners along the stream below.

In 1955 there were about 7,000 acres of tobacco grown in this area and for this crop 2,300 acre feet of water storage would be required. In all there are about 47,000 acres of potential tobacco lands, and on this basis irrigation requirements might amount to 15,700 acre feet in the foreseeable future. These quantities are based on the assumption that the natural rainfall during the irrigation period will offset evaporation and seepage losses.

It is extremely doubtful that if an unlimited amount of water is taken from ground-water storage the other water demands such as domestic use, sustaining the stream flows for fish life, diluting pollution, can be satisfied. Even for irrigation, owing to unequal distribution of the aquifer, some farmers may have plenty and others go short.

There are approximately 25,800 acre feet of storage available in the recommended reservoir sites.

2. POLLUTION

The main sources of pollution are (a) effluent from a large septic tank of old design into which Tillsonburg runs a system of sewers; (b) primary wastes from a milk processing plant at Tillsonburg; (c) cannery wastes at Otterville; (d) private septic tanks and probably sewers at Port Burwell.

Agricultural pollution did not appear to be important over the watershed as a whole.

It seems that there are ways in which pollution can be effectively controlled in the Province of Ontario. The first is by improved technical methods in the operation of treatment plants, both industrial and municipal, and the second method is a much extended system of public education concerning pollution control directed both to individuals and corporations. This would particularly

Pond in Otterville Community Park. This former mill pond is the nucleus of the playgrounds and picnic areas developed at this point. The park is quite well-known throughout the district.

Settling basin for cannery effluent provides partial treatment by removing solid wastes.

Remains of the former Lake St. Joseph dam. This dam could be restored to create a large pond on Otter Creek at Tillsonburg.

stress the need for prevention of the dumping of refuse along the edges of rivers or in their waters. This need is all the more important since the rivers of Southern Ontario are being increasingly used for irrigation, and a diminished flow must be expected, particularly in the Otter Creek Watershed. If a Pollution Control Advisory Board were formed within the Otter Creek Conservation Authority, special study might be given to some of the needs mentioned above.

3. FLOOD PROTECTION

Flooding along the Otter Creek is not nearly as serious as on most of the other watersheds. However, from local newspapers, diaries and eye-witnesses, accounts of a number of floods dating from 1809 to the present have been obtained and it is noted that they have occurred more or less uniformly throughout this 147-year period of record.

Port Burwell, Vienna, Tillsonburg, Norwich and Otterville appear to be the critical areas, with the most persistent flooding occurring in the Tillsonburg area and particularly that low section of Highway No. 3 and the Borden plant at the westerly town limit.

The Tillsonburg reservoir site is ideally located to provide effective flood control for this area and could easily be regulated as a dual-purpose unit to provide the necessary relief. The other reservoir sites, if constructed, would provide a good measure of local control, particularly during spring freshets when they were being filled.

If all the reservoir sites were developed, the storage available, with some minor local channel improvements, would be sufficient to control floods up to the magnitude of any on record but would not be sufficient to guarantee all-time protection against such greater floods as might occur in the future; although the peaks of these floods would be materially reduced with a corresponding decrease in the amount of flood damage sustained.

CHAPTER 5

AVAILABLE CONSERVATION STORAGE

1. GENERAL

All the possible reservoir sites in the area were investigated and seven of these were selected for a more detailed study. These sites were surveyed and contour plans prepared from which the size of dams required for each and the storage capacities were determined.

It is not suggested that all the dams be built until the need arises, but the Authority should acquire the sites now while the land values are reasonable.

2. RESERVOIR SITES

(a) *Acacia*

The damsite is situated in Lot 22, Con. VII, Bayham Township on the East Branch of the Otter Creek about 1 mile upstream from No. 19 Highway.

The site is suitable for a dam 57 feet in height and 460 feet in length which would create a lake 4.7 miles long with an average width of 440 feet and a surface area of 325 acres. When full the lake would have a maximum depth at the dam of 52 feet and a storage capacity of 7,090 acre feet.


NORWICH
NEWARK
SPRINGFORD
OTTERVILLE
UPPER TILLSONBURG
DELMER
LOWER TILLSONBURG
TILLSONBURG
EDEN
SEVILLE
ACACIA
STRAFFORDVILLE
VIENNA
PORT BURWELL
PLAN OF
OTTER CREEK WATERSHED
LEGEND
RESERVOIR SITES RECOMMEN
RESERVOIR SITES INVESTIGATED
GAUGING STATION
EXISTING POND SITES
POSSIBLE POND SITES
AREA SUBJECT TO FLOODING
SCALE - MILES

FIG 1

With a drainage area of 36.3 square miles, this reservoir would control 76 per cent of the run-off from the East Branch.

(b) *Eden*

The damsite is situated in Lot 16, Con. IX, about 1,000 feet north of the road between Cons. VIII and IX, Bayham Township.

The proposed dam would be 49 feet high and 690 feet long with a maximum depth of water at the dam of 44 feet. When full the reservoir would be 4.4 miles long with an average width of 600 feet and a surface area of 412 acres. The maximum storage capacity would be 5,604 acre feet.

The drainage area above this site is 167.4 square miles or approximately 61 per cent of the total for Otter Creek.

(c) *Lower Tillsonburg*

The damsite is located near the townline road between Dereham and Norwich South Townships one mile upstream from the town of Tillsonburg. The dam would be of an earth-fill and concrete type construction, having a maximum height of 47 feet above the bed of the stream and an overall length of 750 feet. At the maximum water level (elevation 730 feet) the reservoir would extend upstream for a distance of 7.7 miles, have a maximum width of about 1,400 feet, a surface area of 360 acres and a storage capacity of 8,068 acre feet.

This is the best reservoir site in the watershed. It is centrally located and, controlling 126.5 square miles or 94 per cent of the total above the town of Tillsonburg, would provide effective flow regulation for this area where the flooding is most frequent and severe.

(d) *Upper Tillsonburg*

This damsite is located in Lot 20, Con. XI, Norwich South Township about ½ mile upstream from the "Rock" mill and dam. The dam would be 41 feet high and 700 feet long and would raise the water 36 feet to elevation 750. At this maximum level the reservoir would be 4.5 miles long and impound 5,840 acre feet of water.

This reservoir is a fair site, being strategically located in the watershed for summer water supply and flood control, but shall only be considered in the event that the lower site is not available when the work is undertaken.

(e) *Delmer*

The damsite is situated on Stony Creek in Lot 15, Con. X, Dereham Township, approximately 1 mile upstream from the hamlet of Delmer.

The dam would be 46 feet high and 800 feet in length. At maximum water level the reservoir would have a depth of 41 feet at the dam, a length of 2 miles and a capacity of 1,270 acre feet.

Preliminary estimates indicate that the cost of this reservoir would be excessive and it is not considered feasible at this time.

(f) *Otterville*

The damsite is located on Branch Creek on the road between Lots 11 and 12, Con. VIII, South Norwich Township, just above the village of Otterville.

The dam would be 46 feet high above the bed of the river and 340 feet long and would create a lake 1.2 miles long with a surface area of 75 acres and a storage capacity of 1,140 acre feet.

This site, with a drainage area of 9.8 square miles, would control all of Branch Creek but would not control sufficient area to give Otterville effective flood relief.

(g) *Springford*

The damsite is situated in Spitler Creek about one-half mile upstream from the road between Concessions VII and VIII, South Norwich Township.

The top of the dam would be 46 feet above the bed of the stream and 790 feet long. The reservoir at maximum water level would be 2 miles long with a surface area of 247 acres and a storage capacity of 3,900 acre feet.

CHAPTER 6

COMMUNITY PONDS

Community ponds, as referred to here, are public ponds, usually larger than the private farm ponds, which may be used to provide bathing, fishing and boating during the summer months and skating and hockey during the winter months or, if conveniently located to an urban centre, as a source of water for domestic supply and/or fire protection. It is well known that water, whether in a flowing stream or pond, greatly enhances the recreational value of park areas by providing these additional facilities and there is no doubt as to the value of an adequate water supply in the event of a major fire.

There are many stretches of streams in the Otter Creek area which, in their present natural state, would make attractive sites for community parks provided the quality and quantity of the stream flow could be depended upon. The conservation reservoirs outlined in the previous chapter would assure an abundance of good water in the streams below the dams.

In some areas the streams may be of sufficient width and depth to offer adequate water facilities but in others small dams may be required to create a pool of sufficient size to serve the purpose. In these areas removable timber dams as illustrated in the accompanying photograph could be constructed at reasonable cost.

Existing ponds on the watershed, provided suitable adjacent lands are available for picnic and playground areas, could also be developed for these centres. The community park at Otterville, which was founded at the turn of the century, would serve as a good example for other communities.

Former millsites with their added historical interests, provided suitable lands for recreation facilities can be made available, can be developed into good community centres. During the 1955 survey 35 old millsites were investigated. Most of the sites were unsuitable for community centres and were eliminated. Five, however, were selected as a choice for consideration.

The Lake St. Joseph site, owing to its central location in the watershed and being close to the town of Tillsonburg, is an ideal site for a community pond provided enough land is available for recreation purposes.

CHAPTER 7

FIELD SURVEYS

The field surveys undertaken were necessarily of a preliminary nature but were of sufficient accuracy and extent to fulfill the needs of this study.

A reconnaissance of the area was made and a number of reservoir sites located. These sites were then examined in more detail and seven of the best were selected to be surveyed for the preparation of contour plans by stereo-projection from aerial photographs.

The contour plans of the Upper and Lower Tillsonburg sites and the Acacia and Eden sites were prepared from field survey data supplied by the Conservation Authorities Branch. These plans were drawn at a scale of 400 feet to the inch with 10-foot contours. The horizontal scale of the photographs was accurately determined by check-chaining stretches of roads or fence-lines between points which could readily be identified on the photographs and comparing the distance between these points scaled from the photographs to the actual distances measured along the ground between the same two points.

For the smaller sites of Springford, Otterville and Delmer the contour plans were prepared by the Conservation Authorities Branch from aerial photographs by means of the Fairchild Stereo-comparagraph.

The surveys for the Acacia, Eden and Delmer sites were made on assumed data.

CHAPTER 8

SUMMARY

In the foregoing report the general physical features of the area under study have been described. These include the size and shape of the area, type of soils, topographical features, length and gradients of streams and the municipalities within the area.

The history of flooding together with an account of the more serious floods has been recorded. These accounts cover the period from 1809 to 1956 and show that at least 25 floods have been recorded in the past 147 years.

The hydrology of the area is outlined in Chapter 3. This includes a summary of the available precipitation and stream flow records and points out that while the average annual rainfall for the area for the period of records is 34.3 inches, annual rainfalls as low as 26.6 inches have been recorded.

The stream flows recorded at Vienna indicated that high flows usually occur in the late winter and early spring when the demand for water is least. Low flows are generally recorded in August, September and October.

In addition to the high spring flows recorded, greater flows may be expected to occur in the future and must be taken into account when considering flow regulation structures such as dams.

Pollution in the streams except at a few isolated points is not serious at present but strict measures will be required shortly to safeguard the streams. Effluents from canneries and milk processing plants contaminate the water and a sewage treatment plant is required at Tillsonburg to take care of the domestic sewage which enters the Otter Creek at that point.

The problem of maintaining adequate water supplies for irrigation is the most pressing one on the watershed at this time. Large volumes of water are being withdrawn from ground water storage and directly from the streams to the detriment of other water users. It is estimated that the average moisture deficiency amounts to 3 inches during the period July 1 to August 15 and that at least 4.0 inches should be provided for this period to prevent crop losses through drought. On the basis of the tobacco crop alone, a minimum of 2,300 acre feet of storage is required for present needs with the demand probably increasing to over 15,000 acre feet in the near future.

An extensive study of the ground water resources of the area, which is beyond the scope of this report, is required to determine the available yield and the ultimate effect of withdrawing large volumes of water from this source.

The reservoirs needed to satisfy the water demands of the area are strategically located for flood control purposes and, if efficiently operated, would provide the necessary protection for all floods up to the magnitude of the greatest recorded for this area.

In addition to large reservoirs, community ponds which would serve either for recreation or as a source of limited water supply for domestic use or fire protection are also recommended.

The field surveys for this work were of a preliminary nature but were considered adequate for the scope of this report. Plans have been prepared and are available when required and a fairly extensive network of bench marks has been established in the area. The plans will be valuable for more detailed studies of the problems and the network of bench marks would greatly expedite any construction work that may be undertaken.

Dam at Otterville—a modern spillway on the site of a dam of 1807.

5 WILDLIFE

CHAPTER 1

INTRODUCTION

On the Otter Creek Watershed, as in much of the rest of Southern Ontario, a shortage of good wildlife habitat is usually the most important single factor limiting the wildlife population. Over-hunting, over-fishing and predation have contributed to the depletion of some species in its final stages. The Provincial Government is now able to exercise control over most of these factors. Considerable research is still being carried on in the methods of management of wildlife populations. The full report covers only the distribution of stream fish, the biological conditions of the streams, and the most generally acceptable methods of improving farms for wildlife, together with a list of birds that may be expected to nest in the area.

CHAPTER 2

IMPROVING THE LAND FOR WILDLIFE

There are many varied types of land in the Otter Creek Watershed. The requirements of food and cover vary greatly for different species of wildlife. The recommendations here listed are therefore those which can be most generally applied by the landowner.

1. WOODLANDS

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will, therefore, come from good management of the farm woodlot.

2. CULTIVATION PRACTICES

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive area is denuded of cover at one time by harvesting. This is of particular importance in an area such as the Otter Creek Watershed, where tobacco growing leaves many fields open much of the year. In the less flat parts of the watershed, filter strips, either above water-diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now becoming more common in the Otter Creek Watershed. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will

moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. *Rosa multiflora* is an excellent hedge-forming shrub. It has a tendency in Southern Ontario to die back in winter, but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground. However, in view of its questionable hardiness, it should not be planted in the Otter Creek Watershed without consultation with the nearest biologists or forester of the Department of Lands and Forests, at Aylmer.

3. COVER PATCHES

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four fields may be made into a haven for ground-nesting species by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation, which is bluegrass.

4. PONDS AND STREAMS

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible, ponds for wildlife should be separate from those intended for cattle or for fish.

The present practice of leaving the spoil banks piled at a steep slope around the edges of new irrigation ponds seems to be a disadvantage to the farmer. Willow cuttings pushed in the ground around hollows will rapidly provide wildlife cover. New water areas are usually very rapidly invaded by aquatic plants, but additional species may have to be introduced.

The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they can be introduced.

Sago Pondweed	*Potamogeton pectinatus L.*
Red-Head Pondweed	*Potamogeton Richardsonii (Ar. Benn.) Rydb.*
Wild Millet	*Echinochloa crusgalli (L) Beauv.*
Japanese Millet	*Echinochloa frumentacea (Roxb) Link*
Wild Celery	*Vallisneria americana Michx.*
Knotweed	*Polygonum pensylvanicum L.*
Water-Smartweed	*Polygonum coccineum Muhl.*
Three-square	*Scirpus americanus Pers.*
Great Bulrush	*Scirpus validus Vahl., var. creber Fern.*
Duckweed	*Spirodela sp. and Lemna sp.*

5. PRESENT SPECIES OF WILDLIFE

The only detailed studies of the distribution of mammals in the vicinity of the Otter Creek Watershed are those by Snyder and Logier, Downing, and

Saunders. Most of the work here mentioned as carried out was concentrated in the Long Point area, which adjoins the Otter Creek Watershed, and which includes several types of vegetation and cover not found in the Otter Creek Watershed. It is therefore not considered justifiable to include such records as a list of the mammals of this area.

To some extent the same remarks apply to the birds of this watershed. There is little doubt that between 270 and 290 species of birds do migrate through the watershed or live in it at some time of the year.

CHAPTER 3

FISH

1. INTRODUCTION

Stream surveys in the Otter Creek drainage basin in 1955 were restricted to three types of work:

(a) A general classification of the waters of the drainage basin defining the suitability of the various parts for different species of fish.

(b) A reconnaissance survey of areas which appeared suitable for spawning of the sea lamprey.

(c) A detailed survey of one area suitable for a demonstration of land and stream improvement for fish and wildlife.

2. METHODS

The rivers and their tributaries were visited at 239 stations from half a mile to three miles apart on each stream course. The topographic features of the valley and the erosion, vegetation, volume of flow, turbidity, temperature and type of bottom were listed for each station. At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made. The collections were later examined and classified and were used in zoning the various sections of the river, as shown on the accompanying maps.

The mayflies, stoneflies and caddisflies were most useful for this purpose since some of them are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and usually clear in summer, such as trout waters. Others are indicators of permanent flow or of polluted waters, or of the maximum summer temperatures of the water. Thus the potentialities of a stream for particular species of fish are indicated. The fish collections substantiated these findings at many stations. Eight maximum-minimum thermometers and one continuous recording thermometer were installed at various points in the stream courses in the early part of July and in some cases were kept in place until September. Readings from the maximum-minimum thermometers were taken at intervals of two or three days.

3. THE RIVER VALLEY

The variety of kinds and numbers of fish in a river system depends greatly on the physiographic conditions of the watershed. The major features determining

A trout stream (part of Little Otter Creek) which here is affected by pollution and silting from its use by cattle. This is near Glen Meyer, in Houghton Township.

A very shallow section of a trout stream which could be deepened with ease to give more fish cover.

Lake Lisgar, in Tillsonburg, a good warm-water pond which, with proper control of all domestic or industrial effluents, should produce a fair annual crop of fish.

the river's condition are therefore mentioned here. The main stream of Otter Creek runs almost continuously in a sand plain from the most northerly point in the watershed down to Tillsonburg. Below Tillsonburg the river runs in a deep and spectacular valley passing through till moraines and clay plains until, at a point near Bayham, the river re-enters the sand plains and continues in a narrow and deep valley to Vienna and Port Burwell.

All of the south branch, except a small section near its confluence with the main river, lies in sand plains. The part of the stream course in Elgin County runs also in a deeply carved valley. There are no major dams or obstructions on the main Otter Creek below Otterville. Almost all of the soils on the eastern side of the watershed are sand and almost all of those on the western side of the watershed are heavier. The chief exception is Stony Creek, whose lower course runs also in a sand plain.

4. PERMANENCE OF FLOW AND TEMPERATURE CONDITIONS

The south branch, which passes almost entirely through sandy land lying on an impermeable clay, has, considering its area, a very strong flow with numerous small co-tributaries. By comparison, many of the tributaries of the main Otter Creek which drain the till moraine and till plain dry to standing pools or dry up completely. Of the 239 stream course stations examined in the watershed 100 had no flow.

Any description of the stream characteristics must take into account the exceptional weather conditions in the summer of 1955. Most notable were the protracted hot spells and the fact that there was almost no rainfall in July.

A second factor which much affected the stream flow for the first time in 1955 was the extent of irrigation. Stony Creek, for example, which in its lower sections appeared to be excellent trout water, was pumped dry several times during the summer.

5. FISH DISTRIBUTION

The Gar pike was found only in the mouth of the river. Brook trout were almost entirely confined to streams rising in the sand plains east of the main Otter, particularly in the east branch and in the Little Otter Creek. Trout also occur north of Otterville. The muddler, a species generally considered as an indicator of trout water, was surprisingly absent from the eastern sandy tributaries. Smallmouth bass are distributed in the main stream from the mouth to a point near Eden. Rock bass were well distributed but apparently absent in the cool east branch and in Little Otter Creek and its tributaries. Northern pike were caught in only two places, but as these fish are more agile than most species they often evade the catcher. The various species of catfish were taken from the main stream only. The single specimen of the channel catfish was from a reach near Vienna.

The commonest of the larger fish in the river, both in numbers and distribution, appeared to be the white sucker and the creek chub. Most of the remaining species in the list are small minnows and other species of little interest to the angler.

More intensive collecting would certainly have added several species to the list of fishes. This is particularly true of the area near the mouth of the

river. For example the alewife, smelt, and the sea lamprey would probably all be taken at the appropriate season. It was also notable that no largemouth bass were collected, although these occur in the adjoining waters of Big Creek.

6. SEA LAMPREYS

A general survey of the permanent waters of the Otter Creek drainage basin as well as the waters of Silver Creek and the small streams running into Lake Erie west of Port Burwell, was made during the last two weeks of June 1955, by walking the streams or by canoe, in a search for lampreys, lamprey nests, suitable streams for lamprey spawning and areas suitable for ammocoetes. The larger creeks were canoed to determine where the rapids furthest down occurred in case any lamprey barrier was contemplated.

(a) *Silver Creek*

The stream was surveyed on June 22, 1955. No evidence of lamprey spawning was found.

(b) *The "Main" Otter Creek*

No evidence of spawning found.

Parts of the stream above Tillsonburg were surveyed near bridges as shown, on June 24, 1955.

The stream at Norwich had no riffles but did have a gravel bottom.

The main creek was canoed from Tillsonburg to Bayham on June 24 and from Bayham to Port Burwell on June 23. The water was quite turbid and fairly deep (4′+) making visual examination of the stream bottom difficult at times.

It is estimated that less than 10 per cent of the stream bottom from Tillsonburg to Bayham is gravel. There were, in the opinion of the field staff, no suitable riffles.

Near Bayham there are a few gravelly rapids, though these were quite heavily silted. The backwaters were mostly of fine sand. The stream bottom is largely sandy, the stream slow-moving. The proportion of gravel on the bottom increases progressively to a point approximately 1 mile upstream from Vienna, beyond which no rapids occur. The stream bottom near Port Burwell is largely silted and is slow-moving and turbid.

The residents of Vienna interviewed had never heard of lamprey spawning in Otter Creek.

There are no dams on the Otter Creek below Otterville.

(c) *The East Branch of Otter Creek*

This stream was surveyed June 29, 1955. No evidence of lamprey spawning was found.

The stream is predominantly sandy bottomed and flows for the most part through wooded pasture. Gravelly riffles occurred occasionally and some of these were considered "possibly suitable" for nesting sites. There are no dams on this stream.

A trout stream in a valley with eroded slopes (part of Little Otter Creek). The erosion of these slopes has resulted in much silting of the stream, as is shown in the photograph below. These slopes should eventually be replanted with trees.

The same trout stream which is shown in the above photograph, here showing the silting which has affected the stream and its banks.

(d) *Little Otter Creek*

This stream was surveyed June 23, 1955. No clear evidence of spawning was found. There are no dams on this creek.

The stream flows mostly through wet bottomlands with the banks overgrown with vegetation. The stream is fairly slow-flowing with the bottom largely sand and sandy silt. Very small patches of gravel (5′ long) occur very infrequently (about one per half mile) and seem improbable for spawning sites. However, a few of these riffles did have scooped out depressions somewhat similar to lamprey nests. When these were stirred up, no evidence of spawn was noted. It was assumed that these were not lamprey nests.

7. STREAM IMPROVEMENTS

It has now been agreed that the greatest improvements in fishing will come chiefly from improvement of the habitat or living quarters of the fish. There are three ways in which conditions can be altered. The first is improvement of the land draining into the stream, which may help to control floods and to prevent silting. The second is improvement of the stream bed and its bank with structures or logs placed in the stream or by planting trees and shrubs on the banks. The third is a direct increase in the flow of the stream during the period of critical flow between the end of June and the beginning of November. The flow may be increased if deep wells are drilled and extra water is released into the stream. This may happen in built-up areas or where industrial plants are built near small streams. However, it is much more common to find the waters of a stream being gradually withdrawn for special uses. A great deal of the water of the tributaries of Otter Creek is now removed by tobacco growers for irrigation purposes. A very great number of farm ponds have also been dug in the Otter Creek drainage basin. It is entirely possible that this may lower the water table and eventually reduce the flow of some tributaries.

As an example for possible stream improvements which landowners might carry out, one of the most suitable streams was selected in 1956 and intensively mapped. This was the tributary of Little Otter Creek, which rises close to the village of Glen Meyer. This is a permanent, cool stream with temperatures satisfactory for speckled trout.


OTTER CREEK
WATERSHED

Conservation makes good conversation - but talk, alone, is not enough. We must act to develop the full potential of our lands and waters, forests and wildlife. Conservation is everybody's responsibility.